Greg Gibson
Vice President, Regulatory Affairs

750 East Pratt Street, Suite 1600
Baltimore, Maryland 21202

UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

September 30, 2009

UN#09-401

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the
Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI No. 141 and RAI No. 142, Regional Climatology

References:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No 141 RSAC 2798.doc" email dated August 24, 2009

2) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "RAI No 142 RSAC 2112.doc" email dated August 24, 2009

The purpose of this letter is to respond to the requests for additional information (RAIs) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated August 24, 2009 (References 1 and 2). These RAIs address Regional Climatology, as discussed in Section 2.3.1 of the Final Safety Analysis Report, as submitted in Part 2 of the CCNPP Unit 3 Combined License Application (COLA), Revision 5.

The enclosure provides our response to RAI No. 141, Questions 02.03.01-14 through 02.03.01-16, and RAI No. 142, Questions 02.03.01-17 through 02.03.01-20, and includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA.

D096
NRO

Our responses to RAI No. 141, Questions 02.03.01-14 through 02.03.01-16, and RAI No. 142, Questions 02.03.01-17 through 02.03.01-20, do not include any new regulatory commitments, nor do they not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Michael J. Yox at (410) 495-2436.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on September 30, 2009

for Greg Gibson

Enclosure: Response to NRC Request for Additional Information RAI No. 141, Questions 02.03.01-14 through 02.03.01-16, and RAI No. 142, Questions 02.03.01-17 through 02.03.01-20, Regional Climatology, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Loren Plisco, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
U.S. NRC Region I Office

GTG/RDS/ms

UN#09-401

Enclosure

Response to NRC Request for Additional Information
RAI No. 141, Questions 02.03.01-14 through 02.03.01-16, and
RAI No. 142, Questions 02.03.01-17 through 02.03.01-20, Regional Climatology,
Calvert Cliffs Nuclear Power Plant, Unit 3

RAI No. 141

Question 02.03.01-14

The Staff considered the Applicant's response to RAI Question No. 02.03.01-2 for the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 combined license (COL) Final Safety Analysis Report (FSAR) ("RAI Response"), submitted on October 30, 2008 (ML083100776), on the frequencies of tropical storms and hurricanes within 100 statute miles of Calvert County, Maryland. The following items need to be addressed to fully resolve the Staff's concerns regarding revised Paragraph 3 of CCNPP Unit 3 FSAR Section 2.3.1.2.2.2, as revised in the RAI Response:

- the consideration of tropical cyclone events was limited to those events that were classified as hurricanes or tropical storms; the absence of tropical cyclone events just below the tropical storm wind speed criterion may result in underestimating high wind and rainfall statistics, and
- the use of the NOAA Coastal Services Center (NOAA-CSC) historical hurricane tracks online database was not consistent; this appears to have resulted in an undercount of events.

The Staff is concerned that extreme wind and/or precipitation (rainfall) events in the site area may not be fully considered because certain tropical cyclone events, specifically events other than those classified as hurricanes or tropical storms, may still be important in the analysis. The exclusion of these tropical cyclone events does not appear to meet the intent of the guidance in NUREG-0800, Standard Review Plan Section 2.3.1, Section I (Areas of Review (i.e., the extreme climatic conditions and regional meteorological phenomena that could affect the safe design and siting of the plant), or Regulatory Guide 1.206, Section C.I.2.3.1.2, Paragraph 2, (Sentence 1). The historical frequency of hurricanes, while identified specifically in the guidance, is a very important severe weather phenomenon; however, it should not be considered as the only criterion that affects the safe design and siting of the plant. For example, persistent and slow moving tropical cyclones could result in extreme precipitation events that are important in the analysis.

The Staff independently confirmed the tropical cyclone counts in Tables 1 and 2 of the RAI Response by querying by Place Name (for Calvert County) in the NOAA-CSC database. Regarding Table 3 of the RAI Response, the Staff's query of the NOAA-CSC database resulted in 28 events (64 line entries), but Table 3 lists only 19 of those events (39 line entries). The Staff believes that Hurricane Floyd; Tropical Storms Cindy and Camille; Tropical Depressions Beryl and Dennis; Extra-Tropical Storms Hazel, Danny, and Charley; and, Sub-Tropical Depression Allison should be considered in the analysis.

Therefore, please address the following technical issues:

(a) Either (1) provide the rationale for excluding the 9 additional events identified by the Staff in the Table 3 query, or (2) confirm the frequency of tropical cyclone occurrences for the period of record 1950 to date as reported in Table 3 of the RAI Response using a consistent query type as was used in Tables 1 and 2 of the RAI Response and the Staff's independent confirmation.

(b) If Item (a) is addressed by confirming the frequency of tropical cyclone occurrences (Option 2 above), update CCNPP Unit 3 FSAR Section 2.3.1.2.2.2 and any related table(s) to include the frequencies of occurrence of all tropical cyclone classifications that occurred within 100 statute miles of Calvert County and determine whether or not the update changes the assessment of the design or siting of the plant considering extreme climatic conditions and regional meteorological phenomena. If Item (a) is addressed by providing a rationale for having excluded the nine additional tropical cyclone events identified by the Staff (Option 1 above), then update CCNPP Unit 3 FSAR Section 2.3.1.2.2.2 accordingly.

Response

The frequency of tropical cyclone occurrences for the period of record 1952 through 2008 was confirmed using a query for Calvert County, Maryland. Tables 1, 2 and 3 below contain listings of storms derived from the National Oceanic and Atmospheric Administration (NOAA) website[1]. Tables 1 and 2 remain unchanged from the response provided to RAI 5, Question 02.03.01-2[2]. The nine additional events identified by the NRC Staff in RAI 141, Question 02.03.01-14, are included in Table 3. Tables 1, 2 and 3 form the basis for the number of tropical storms and hurricanes that have passed within 100 statute miles (161 kilometers) of Calvert County from 1851 through 2008, as discussed in FSAR Section 2.3.1.2.2.2.

For this evaluation, if a storm was listed as more than one type of storm, it was counted only as the stronger storm; i.e., if a storm was listed as both a hurricane and a tropical storm, it was counted as a hurricane. Sub-tropical storms, subtropical depressions, and extratropical storms were also counted.

---

[1] Historical Hurricane Tracks, National Oceanic and Atmospheric Administration, Coastal Services Center, Website: http://maps.csc.noaa.gov/hurricanes/viewer.html?QE=USPLACE&STATE=maryland, Date accessed: April 16, 2007.

[2] G. Gibson (UniStar Nuclear Energy) to Document Control Desk (NRC), "Submittal of Response to Requests for Additional Information for the Calvert Cliffs Nuclear Power Plant Unit 3 – Meteorology," letter UN#08-055, dated October 30, 2008 (Adams Accession No. ML083100776).

The findings for the time period from 1952 through 2008 are:

Extratropical Storm **(E)**	Subtropical Depression **(SD)**	Subtropical Storm **(SS)**	Tropical Depression **(TD)**	Tropical Storm **(TS)**	Hurricane **(H)**
HAZEL	ALLISON	NONE	CAMILLE	ABLE	FLOYD
DANNY			GINGER	CONNIE	
GORDAN			BOB	DIANE	
CHARLIE			CHRIS	CINDY (1959)	
CINDY (2005)			BERYL	BRENDA	
ERNESTO			DENNIS	NOTNAMED (1961)	
			IVAN	DORIA	
			JEANNE	BRET	
				DEAN	
				DANIELLE	
				BERTHA	
				GASTON	
				HANNA	
Total	Total	Total	Total	Total	Total
6	**1**	**0**	**8**	**13**	**1**

The totals for each storm type for the time periods denoted in Tables 1 and 2 are:

Extratropical Storm **(E)**	Subtropical Depression **(SD)**	Subtropical Storm **(SS)**	Tropical Depression **(TD)**	Tropical Storm **(TS)**	Hurricane **(H)**
10	**0**	**0**	**3**	**25**	**5**

Therefore, the overall totals for each storm type for the period from 1851 through 2008 are:

Extratropical Storm **(E)**	Subtropical Depression **(SD)**	Subtropical Storm **(SS)**	Tropical Depression **(TD)**	Tropical Storm **(TS)**	Hurricane **(H)**
16	**1**	**0**	**11**	**38**	**6**

This revised evaluation does not change the assessment of the design or siting of the plant considering extreme climatic conditions and regional meteorological phenomena.

Table 1 (from response to RAI 2.3.1-2)
Output for tropical storms and hurricanes that have passed within 100 statute miles (161 kilometers) of Calvert Country from 1851 through 1899

Rec	YEAR	MONTH	DAY	STORM NAME	WIND SPEED(KTS)	PRESSURE(MB)	CATEGORY
1	1856	8	19	NOTNAMED	50	0	TS
2	1856	8	20	NOTNAMED	50	0	TS
3	1856	8	20	NOTNAMED	50	0	TS
4	1859	9	17	NOTNAMED	50	0	TS
5	1861	9	27	NOTNAMED	60	0	TS
6	1861	9	28	NOTNAMED	60	0	TS
7	1863	9	18	NOTNAMED	50	0	TS
8	1863	9	19	NOTNAMED	50	0	TS
9	1872	10	25	NOTNAMED	40	0	TS
10	1872	10	26	NOTNAMED	40	0	TS
11	1872	10	26	NOTNAMED	40	0	TS
12	1874	9	29	NOTNAMED	50	0	TS
13	1874	9	29	NOTNAMED	50	0	TS
14	1876	9	17	NOTNAMED	70	985	H1
15	1876	9	18	NOTNAMED	60	987	TS
16	1877	10	4	NOTNAMED	50	0	E
17	1878	10	23	NOTNAMED	90	0	H2
18	1878	10	23	NOTNAMED	80	975	H1
19	1879	8	18	NOTNAMED	100	971	H3
20	1879	8	18	NOTNAMED	90	979	H2
21	1881	9	10	NOTNAMED	50	0	TS
22	1881	9	10	NOTNAMED	50	0	TS
23	1882	9	11	NOTNAMED	40	0	TS
24	1882	9	23	NOTNAMED	40	1005	TS
25	1882	9	23	NOTNAMED	40	0	TS
26	1882	9	23	NOTNAMED	40	0	TS
27	1883	9	12	NOTNAMED	40	0	TS
28	1883	9	13	NOTNAMED	30	0	TD
29	1885	10	13	NOTNAMED	40	0	E
30	1885	10	13	NOTNAMED	40	0	E
31	1886	6	23	NOTNAMED	30	0	TD
32	1886	6	23	NOTNAMED	30	0	TD
33	1886	6	23	NOTNAMED	30	0	TD
34	1886	7	2	NOTNAMED	35	0	TS
35	1886	7	2	NOTNAMED	35	0	TS
36	1888	9	11	NOTNAMED	35	0	TS
37	1888	9	11	NOTNAMED	35	0	TS
38	1888	9	11	NOTNAMED	35	0	E
39	1889	9	24	NOTNAMED	40	0	TS
40	1889	9	25	NOTNAMED	40	0	TS
41	1889	9	25	NOTNAMED	40	0	TS
42	1893	8	29	NOTNAMED	55	0	TS

Table 1 (from response to RAI 2.3.1-2)
Output for tropical storms and hurricanes that have passed within 100 statute miles (161 kilometers) of Calvert Country from 1851 through 1899

Rec	YEAR	MONTH	DAY	STORM NAME	WIND SPEED(KTS)	PRESSURE(MB)	CATEGORY
43	1893	10	13	NOTNAMED	80	0	H1
44	1893	10	14	NOTNAMED	65	0	H1
45	1893	10	23	NOTNAMED	45	0	TS
46	1893	10	23	NOTNAMED	40	0	TS
47	1894	10	10	NOTNAMED	60	0	TS
48	1894	10	10	NOTNAMED	65	0	H1
49	1899	10	31	NOTNAMED	55	0	TS
50	1899	11	1	NOTNAMED	50	0	E

Table 2 (from response to RAI 2.3.1-2)
Output for tropical storms and hurricanes that have passed within 100 statute miles (161 kilometers) of Calvert Country from 1902 through 1949

Rec	YEAR	MONTH	DAY	STORM NAME	WIND SPEED(KTS)	PRESSURE(MB)	CATEGORY
1	1902	6	16	NOTNAMED	40	0	E
2	1902	10	12	NOTNAMED	35	0	E
3	1904	9	15	NOTNAMED	55	0	TS
4	1905	10	11	NOTNAMED	25	0	E
5	1915	8	4	NOTNAMED	40	0	TS
6	1915	8	4	NOTNAMED	40	0	TS
7	1916	5	16	NOTNAMED	35	0	TS
8	1916	5	17	NOTNAMED	40	0	E
9	1923	10	23	NOTNAMED	55	0	E
10	1923	10	24	NOTNAMED	50	0	E
11	1923	10	24	NOTNAMED	45	0	E
12	1924	9	30	NOTNAMED	35	0	E
13	1927	10	4	NOTNAMED	30	0	TD
14	1928	8	12	NOTNAMED	30	0	E
15	1928	8	12	NOTNAMED	30	0	E
16	1928	9	19	NOTNAMED	40	989	TS
17	1928	9	19	NOTNAMED	40	0	TS
18	1928	9	20	NOTNAMED	40	1002	TS
19	1929	10	2	NOTNAMED	35	0	E
20	1929	10	2	NOTNAMED	35	0	E
21	1929	10	3	NOTNAMED	35	0	E
22	1933	8	23	NOTNAMED	60	971	TS
23	1933	8	23	NOTNAMED	50	0	TS
24	1933	8	24	NOTNAMED	45	0	TS
25	1934	6	19	NOTNAMED	40	0	E
26	1934	6	19	NOTNAMED	40	0	E
27	1939	8	19	NOTNAMED	25	0	TD
28	1939	8	19	NOTNAMED	25	0	TD
29	1939	8	19	NOTNAMED	25	0	TD
30	1939	8	20	NOTNAMED	25	0	TD
31	1943	10	1	NOTNAMED	35	0	TS
32	1943	10	1	NOTNAMED	30	0	TD
33	1944	8	2	NOTNAMED	45	0	TS
34	1944	8	2	NOTNAMED	40	0	TS
35	1944	8	3	NOTNAMED	35	0	TS
36	1944	10	20	NOTNAMED	35	996	TS
37	1944	10	21	NOTNAMED	35	998	E
38	1944	10	21	NOTNAMED	40	997	E
39	1945	9	18	NOTNAMED	35	1012	TS
40	1945	9	18	NOTNAMED	30	0	E
41	1949	8	29	NOTNAMED	40	1000	TS

Table 3
Output for tropical storms and hurricanes that have passed within 100 statute miles (161 kilometers) of Calvert Country from 1952 through 2006

Rec	YEAR	MONTH	DAY	STORM NAME	WIND SPEED(KTS)	PRESSURE(MB)	CATEGORY
1	1952	9	1	ABLE	35	0	TS
2	1952	9	1	ABLE	35	0	TS
3	1954	10	15	HAZEL	80	970	E
4	1955	8	13	CONNIE	60	969	TS
5	1955	8	13	CONNIE	50	974	TS
6	1955	8	13	CONNIE	45	982	TS
7	1955	8	18	DIANE	55	999	TS
8	1955	8	18	DIANE	50	1001	TS
9	1955	8	18	DIANE	45	1004	TS
10	1959	7	10	CINDY	30	0	TD
11	1959	7	10	CINDY	35	0	TS
12	1960	7	30	BRENDA	50	0	TS
13	1960	7	30	BRENDA	45	0	TS
14	1961	9	14	NOTNAMED	35	0	TS
15	1961	9	15	NOTNAMED	35	0	TS
16	1969	8	20	CAMILLE	25	0	TD
17	1969	8	20	CAMILLE	25	0	TD
18	1971	8	28	DORIA	55	0	TS
19	1971	8	28	DORIA	50	993	TS
20	1971	10	2	GINGER	30	0	TD
21	1971	10	3	GINGER	30	0	TD
22	1971	10	3	GINGER	30	1008	E
23	1979	7	14	BOB	20	1010	TD
24	1979	7	14	BOB	20	1010	TD
25	1979	7	15	BOB	20	1011	TD
26	1981	7	1	BRET	50	1000	TS
27	1981	7	1	BRET	30	1006	TD
28	1983	9	30	DEAN	55	1009	TS
29	1983	9	30	DEAN	40	1010	TS
30	1985	8	19	DANNY	25	1012	E
31	1985	8	19	DANNY	25	1012	E
32	1985	8	19	DANNY	25	1012	E
33	1988	8	29	CHRIS	20	1009	TD
34	1988	8	29	CHRIS	20	1010	TD
35	1992	9	25	DANIELLE	55	1007	TS
36	1992	9	26	DANIELLE	40	1008	TS
37	1992	9	26	DANIELLE	35	1010	TS
38	1994	8	18	BERYL	15	1011	TD
39	1994	8	18	BERYL	15	1011	TD
40	1996	7	13	BERTHA	60	993	TS
41	1996	7	13	BERTHA	60	994	TS
42	1999	9	7	DENNIS	20	1009	TD

Table 3
Output for tropical storms and hurricanes that have passed within 100 statute miles (161 kilometers) of Calvert Country from 1952 through 2006

Rec	YEAR	MONTH	DAY	STORM NAME	WIND SPEED(KTS)	PRESSURE(MB)	CATEGORY
43	1999	9	16	FLOYD	70	967	H1
44	1999	9	16	FLOYD	60	974	TS
45	2000	9	19	GORDON	20	1010	E
46	2000	9	19	GORDON	25	1008	E
47	2001	6	16	ALLISON	25	1006	SD
48	2001	6	17	ALLISON	25	1006	SD
49	2004	8	15	CHARLEY	40	1012	E
50	2004	8	30	GASTON	30	1002	TD
51	2004	8	31	GASTON	35	1001	TS
52	2004	9	18	IVAN	15	998	TD
53	2004	9	18	IVAN	15	1000	TD
54	2004	9	18	IVAN	25	1002	E
55	2004	9	28	JEANNE	25	999	TD
56	2004	9	29	JEANNE	25	999	E
57	2005	7	8	CINDY	20	1010	E
58	2005	7	8	CINDY	25	1009	E
59	2006	9	1	ERNESTO	40	997	E
60	2006	9	2	ERNESTO	40	1002	E
61	2006	9	2	ERNESTO	40	1005	E
62	2006	9	2	ERNESTO	40	1007	E
63	2006	9	2	ERNESTO	40	1010	E
64	2006	9	3	ERNESTO	35	1012	E
65	2008	9	6	HANNA	45	985	TS
66	2008	9	6	HANNA	45	993	TS

Key:

Hx	Hurricane, Category x (1, 2, 3, 4, 5)
TS	Tropical Storm
TD	Tropical Depression
E	Extra-tropical storm

COLA Impact

FSAR Section 2.3.1.2.2.2, third paragraph, will be revised as follows in a future COLA revision:

2.3.1.2.2.2 Hurricanes

~~The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center reports that there were 42 tropical storms and hurricanes that passed within 100 statute miles (161 km) of Calvert County, Maryland, during the period from 1851 through 2006. Of these 42 events, three were Category 1 hurricanes, one was a Category 2 hurricane, and one was a Category 3 hurricane (NOAA, 2007c). The hurricanes occurred in the months of August, September, and October. The tropical storms occurred in the months of May, July, August, September, and October.~~

The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center reports that there were 6 hurricanes, 38 tropical storms, 11 tropical depressions, one subtropical depression, and 16 extratropical storms that passed within 100 statute miles (161 km) of Calvert County, Maryland, during the period from 1851 through 2008. Of the 6 hurricane events, four were Category 1 hurricanes, one was a Category 2 hurricane, and one was a Category 3 hurricane (NOAA, 2009a). The hurricanes occurred in the months of August, September, and October. The tropical storms occurred in the months of May, July, August, September, and October.

FSAR Section 2.3.1.2.3 will be supplemented as follows in a future COLA revision:

2.3.1.2.3 References

NOAA, 2009a. Historical Hurricane Tracks, National Oceanic and Atmospheric Administration, Coastal Services Center, Website: http://csc-s-maps-q.csc.noaa.gov/hurricanes/viewer.html, Date accessed: August 21, 2009.

COLA, Part 3, Environmental Report, Section 2.7.3.2, third paragraph, will be revised as follows in a future COLA revision:

2.7.3.2 Hurricanes and Tropical Storms

~~The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center reports that there were 42 tropical storms and hurricanes that passed within 100 statute miles (161 km) of Calvert County, Maryland, during the period from 1851 through 2006. Of these 42 events, three were Category 1 hurricanes, one was a Category 2 hurricane, and one was a Category 3 hurricane (NOAA, 2007b). The hurricanes occurred in the months of August, September, and October. The tropical storms occurred in the months of May, July, August, September, and October.~~

The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center reports that there were 6 hurricanes, 38 tropical storms, 11 tropical depressions, one subtropical depression, and 16 extratropical storms that passed within 100 statute miles (161 km) of Calvert County, Maryland, during the period from 1851 through 2008. Of the 6 hurricane events, four were Category 1 hurricanes, one was a Category 2 hurricane, and one was a Category 3 hurricane (NOAA, 2009a). The hurricanes occurred in the months of August, September, and October. The tropical storms occurred in the months of May, July, August, September, and October.

COLA, Part 3, Environmental Report, Section 2.7.8 will be supplemented as follows in a future COLA revision:

2.7.8 References

NOAA, 2009a. Historical Hurricane Tracks, National Oceanic and Atmospheric Administration, Coastal Services Center, Website: http://csc-s-maps-q.csc.noaa.gov/hurricanes/viewer.html, Date accessed: August 21, 2009.

Question 02.03.01-15

After considering the Applicant's response to RAI Question No. 02.03.01-2 for the CCNPP Unit 3 FSAR ("RAI Response"), submitted on October 30, 2008 (ML083100776), the Staff has a concern about the absence of a discussion of extreme wind conditions associated with tropical cyclone events that have occurred within 100 statute miles of Calvert County, Maryland. Tropical cyclone-related wind speeds may exceed the site characteristic 3-second gust wind speeds reported elsewhere in CCNPP Unit 3 FSAR Section 2.3.1 and Table 2.0-1 and may, therefore, represent the maximum wind speed (other than tornado) for consideration in the safe design and siting of the plant.

10 CFR 52.79(a)(1)(iii) states, in part, that a COL FSAR must identify the meteorological characteristics of the proposed site with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

The Staff has independently identified several tropical cyclone events that have occurred within 100 statute miles of Calvert County, Maryland over the 156-year period of record (1851 through 2006) queried from the NOAA-Coastal Services Center (NOAA-CSC) online database. These events include three unnamed hurricanes (Category 3 - in August 1879, Category 2 - in October 1878, and Category 1 - in October 1893) and a then-downgraded extra-tropical cyclone in October 1954 (formerly Hurricane Hazel, at times classified as a Category 4 and Category 3 storm). The maximum sustained wind speeds associated with these events are reported as 100, 90, 80, and 80 knots, respectively, and likely have 3-second gust wind speeds greater than the site characteristic values of 101.7 miles per hour (mph) for the 100-year return period 3-second gust, as stated in CCNPP Unit 3 FSAR Section 2.3.1.2.2.15, and 95 mph for the 50-year return period 3-second gust, as stated in CCNPP Unit 3 FSAR Section 2.3.1.2.2.15 and Table 2.0-1.

The Staff notes that the hurricane with the highest sustained wind speed appears to have occurred on the perimeter of the 100-statute mile radial area and need not be considered further as it did not make landfall within this radial area. However, the hurricane with the second highest sustained wind (90 knots) was over land during its entire traverse of this radial area and its track was within about 40 miles of the CCNPP site. The Staff further notes that an observed gust of 110 knots was reported in the NCDC's International Station Meteorological Climate Summaries for the Patuxent River Naval Air Station (NAS) in October 1954.

The Applicant should address the following technical issues in order to fully resolve the Staff's concern that the site characteristic maximum wind speed (other than tornado) may not have been identified pursuant to 10 CFR 52.79(a)(1)(iii):

(a) Either (1) provide the rationale for excluding extreme wind speed events associated with the passage of tropical cyclones in the site area, or (2) determine the controlling site characteristic 3-second gust wind speed for the site and surrounding area by also taking into consideration extreme wind speed events associated with the passage of tropical cyclones in the site area and evaluating whether or not the magnitude of such events

changes the assessment of the design or siting of the plant considering extreme climatic conditions and regional meteorological phenomena.

(b) In either case, update CCNPP Unit 3 FSAR Section 2.3.1.2.2.2, Section 2.3.1.2.2.15, and Table 2.0-1 accordingly. If a 3-second gust wind speed is estimated from a maximum reported sustained wind speed (e.g., from the NOAA-CSC database), then explain the method used to determine the estimated value.

Response

FSAR Section 2.3.1.2.2.15 presents the 100-year return period 3-second wind gust value for the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 site. The gust value was determined using the methodology of ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures." The basic wind speeds provided in Figure 6-1 of ASCE 7-05 include the results of an analysis of hurricane wind speeds (see Section C6.5.4 of ASCE 7-05).

NUREG-0800 states in Section I.6.d that the 100-year return period (straight line) 3-second gust wind speed is to be used in establishing wind loading on plant structures. In Section II, SRP Acceptance Criteria number 4, it is stated that the basic (straight line) 100-year return period 3-second gust wind speed should be based on appropriate standards, with suitable corrections for local conditions. The standard referenced in the SRP is ASCE 7-05. ASCE 7-05 indicates that the wind speed values include the effects of hurricane winds. Thus it appears that the guidance has been followed. The Staff's question suggests that the maximum observed sustained hurricane wind speed should be converted to a 3-second wind gust value and used as the 100-year return period (straight line) 3-second gust wind speed for establishing wind loading on plant structures. Such a converted value would not be a 100-year return period value. The standard indicates that wind loading should be determined using the 100-year return period value, not the maximum observed wind speed.

It should be noted that the 100-year return period 3-second wind gust value is not used in the determination of wind loads on safety-related structures.

COLA Impact

FSAR Section 2.3.1.2.2.15 will be updated as follows in a future COLA revision:

2.3.1.2.2.15 100 Year Return Period 3 Second Wind Gust

In accordance with ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures," (ASCE, 2006), the basic wind speed to be used in the determination of design wind loads on buildings and other structures is given in Figure 6-1 of that document. The wind speeds provided in Figure 6-1 include the results of an analysis of hurricane winds. This value for the CCNPP site is 95 mph (42 mps). Note that this value is the 3 second wind gust for a 50 year return period. Using the appropriate conversion factor from Table C6-7 of ASCE 7-05 (ASCE, 2006), the 100 year return period 3 second wind gust value is 95 mph X 1.07 = 101.65 mph (45.4 mps).

Question 02.03.01-16

The Staff considered the Applicant's response to RAI Question No. 02.03.01-2 for the CCNPP Unit 3 FSAR ("RAI Response"), submitted on October 30, 2008 (ML083100776), with respect to rainfall totals associated with the passage of tropical cyclones within 100 statute miles of Calvert County, Maryland. The following items need to be addressed to fully resolve the Staff's concerns regarding Paragraph 4 of CCNPP Unit 3 FSAR Section 2.3.1.2.2.2 (as originally stated) and Paragraphs 6 and 7 of the RAI Response:

- identification of precipitation (rainfall) totals for certain tropical cyclone events was limited to information only available in the National Climatic Data Center's (NCDC) on-line "Storm Events" database; and
- only tropical cyclone events that tracked within 100 statute miles of Calvert County, Maryland, appear to have been taken into account.

The Staff is concerned that the rainfall totals may be understated because the NCDC "Storm Events" database is not currently populated with precipitation observations prior to 1993 although the output header for queries of these events indicates (incorrectly) that the period of record (POR) extends from January 1, 1950 to date. The Staff believes that the number of tropical cyclone events that produced extreme amounts of rainfall in the site area may be understated as well. These types of information provide context for the relationships between synoptic-scale processes and meteorological conditions in the site area consistent with Regulatory Guide (RG) 1.206 (Section C.I.2.3.1.1 and Section C.I.2.3.2.1, Item 3) and NUREG-0800, Standard Review Plan (SRP) Section 2.3.1, Section I (Areas of Review), Item 1, and perspective on the reasonability of the design basis rainfall site parameter and site characteristic values in CCNPP Unit 3 FSAR Section 2.4 and Table 2.0-1.

Based on the NCDC's TD3200/3210 (Surface Summary of the Day) data files and information available on-line from the Southeast Regional Climate Center (SERCC) for the State of Maryland at http://www.sercc.com/climateinfo/historical/historical.html, the Staff was able to independently identify several significant and/or record 24-hour rainfall totals at observing stations within 25 miles of the site that were not identified in CCNPP Unit 3 FSAR Section 2.3.1.2.2.2, Paragraph 4 or elsewhere in FSAR Section 2.3. These extreme rainfall events were associated with the passage of tropical cyclones both within and beyond the 100-statute-mile radius around Calvert County, Maryland, and include:

- for tropical cyclones within 100 statute miles, several historical 24-hour record totals at nearby cooperative observing stations – 8.60 inches at the Blackwater Refuge and 7.43 inches at the Prince Frederick 1N stations due to Tropical Storm Connie; 8.10 inches at the Mechanicsville 5NE station due to then Extra-Tropical Cyclone Ernesto; and 7.90 inches at the Royal Oak 2 SSW station due to Hurricane Floyd; and
- for tropical cyclones beyond 100 statute miles, several significant 24-hour totals at nearby cooperative stations, including 10.30 inches at the Cambridge Water Treatment Plant (station record) and 7.40 inches at the Solomons station (second highest for that location) due to an unnamed Category 1 hurricane and tropical cyclone.

Therefore, the Applicant should address the following technical issues:

(a) Either (1) provide the rationale for excluding extreme rainfall events that occurred prior to 1993 and/or that are associated with tropical cyclone tracks farther than 100 statute miles from Calvert County, Maryland, or (2) identify historical tropical cyclone-related extreme rainfall events that have occurred in the site area, regardless of a storm's track within or beyond 100 statute miles of Calvert County, Maryland, using data sources that cover longer PORs.

(b) If Item (a) is addressed by identifying historical tropical cyclone-related extreme rainfall events that have occurred within or beyond 100 statute miles of Calvert County, Maryland (Option 2 above), expand the data resources evaluated beyond the limited "Storm Events" database. The applicant may wish to consider the following data sources, among others, in identifying extreme rainfall events in the site area:

- NCDC TD3200/3210 (Surface Summary of the Day) data files (Reference 17 in SRP Section 2.3.1);
- NCDC Climatography of the United States No. 20 (highest daily total rainfall limited to station's available digital record);
- SERCC (referred to previously, may have longer PORs than digitized in other NCDC products); and
- NCDC "Storm Data" monthly publication (predecessor to "Storm Events", provides narrative summaries of severe weather events beginning in January 1959) (Reference 8 in SRP Section 2.3.1).

If Item (a) is addressed by providing a rationale for having excluded extreme rainfall events that occurred prior to 1993 and/or that are associated with tropical cyclone tracks farther than 100 statute miles from Calvert County, Maryland (Option 1 above), then update CCNPP Unit 3 FSAR Section 2.3.1.2.2.2 accordingly.

(c) In determining whether an extreme rainfall event may be reasonably expected to occur at the Calvert Cliffs site (regardless of whether it is associated with the passage of a tropical cyclone), observations considered should not be limited to those recorded only in Calvert County. RG 1.206, Section C.I.2.3.2.1 calls for "long-term data from nearby reasonably representative locations (e.g., within 50 miles (80 km)) [of the site]". Therefore, update CCNPP Unit 3 FSAR Section 2.3.1.2.2.2 to provide tropical cyclone-related extreme rainfall data beyond Calvert County, Maryland, in accordance with this guidance (i.e., within 50 miles of the site), or justify an alternative size area for the selection of reasonably representative locations for obtaining data. In either case, update CCNPP Unit 3 FSAR Section 2.3.1.2.2.2 accordingly.

The applicant may wish to consider, among others, observations from nearby Maryland counties such as St. Mary's, Dorchester, and Talbot. Furthermore, in expanding the area for identifying any reasonably representative overall maximum 24-hour and monthly rainfall totals from among the NCDC-based data sources identified in part (b) of this question, the applicant should consider nearby NCDC cooperative observing network stations with long-term PORs, including, among others: Solomons; Patuxent River Naval Air Station; Prince Frederick 1N; Mechanicsville 5NE; Blackwater Refuge; Cambridge 4W; Owings Ferry Landing; Cambridge Water Treatment Plant; and Royal Oak 2SSW.

Response

Historical tropical cyclone-related extreme rainfall events that have occurred within the site area over a period of record longer than that in the National Climatic Data Center (NCDC) Storm Events website have been identified by using the additional data resources identified by the NRC staff.

The following tropical cyclone-related extreme rainfall events were identified:

Location	Precipitation inches (mm)	Storm
Cambridge Water Treatment Plant, MD	10.3 (261.6)	Unnamed September 1935
La Plata, MD	9.8 (248.9)	Doria August 1971
Blackwater Refuge, MD	8.6 (218.4)	Connie August 1955
Annapolis Police Barracks, MD	8.32 (211.3)	Floyd September 1999
Easton Police Barracks, MD	8.26 (209.8)	Unnamed September 1935
Mechanicsville, MD	8.1 (205.7)	Ernesto September 2006
Royal Oak, MD	7.9 (200.7)	Floyd September 1999
Prince Frederick MD	7.43 (188.7)	Connie August 1955
Solomons, MD	7.4 (188.0)	Unnamed September 1935
Preston, MD	7.14 (181.4)	Donna September 1960
Glenn Dale Bell Station, MD	6.98 (177.3)	Connie August 1955
Owings Ferry Landing, MD	6.54 (166.1)	Gloria September 1985
Fort Meade, MD	6.48 (164.6)	Connie August 1955
Waldorf Police Barracks, MD	6.45 (163.8)	Connie August 1955
Washington National Airport, VA	6.11 (155.2)	Agnes June 1972
Crisfield Somers Cove, MD	4.6 (116.8)	Camille August 1969

COLA Impact

FSAR Section 2.3.1.2.2.2 will be revised as follows in a future COL revision:

2.3.1.2.2.2 Hurricanes

~~Precipitation estimates from the remnants of Tropical Storm Ernesto, Bill, and Allison were presented in FSAR Section 2.3.1.2.2.2. These data were obtained from the National Climatic Data Center Storm Events database (NOAA, 2007a), under precipitation events in Calvert County for dates June 15, 2001 (Allison), July 3, 2003 (Bill), and September 1, 2006 (Ernesto).~~

~~Rainfall amounts for Calvert County, Maryland, were not included in the National Climatic Data Center Storm Events database for the remnants of Hurricane Floyd and were therefore unavailable for inclusion in the FSAR.~~

~~On September 1, 2006, the remnants of Tropical Storm Ernesto dropped between 7 to 10 in (178 to 254 mm) of rain in Calvert County. On July 3, 2003, the remnants of Tropical Storm Bill dropped over 2 in (51 mm) of rain in parts of Calvert County. On June 15, 2001, the remnants of Tropical Storm Allison dropped between one and one-half and three and one-half inches (38 to 89 mm) of rain on Calvert County (NOAA, 2007a).~~

Historical tropical cyclone-related extreme rainfall events that have occurred within the site area over a period of record from 1851 through 2008 were identified using information from (NOAA, 2009a), (NOAA, 2009b), (SERCC, 2009). These events are presented in Table 2.3-136.

The maximum tropical cyclone-related extreme rainfall event was 10.3 in (261.6 mm) at the Cambridge Water Treatment Plant, MD, in September 1935 from an unnamed storm. The second-highest event was 9.8 in (248.9 mm) at La Plata, MD, in August 1971 from Doria. The third-highest event was 8.6 in (218.4 mm) at Blackwater Refuge, MD, in August 1995 from Connie.

FSAR Section 2.3.1.2.3 will be supplemented as follows in a future COLA revision:

2.3.1.2.3 References

NOAA, 2009b. Surface Summary of the Day data files, TD 3200, National Oceanic and Atmospheric Administration/National Environmental Satellite, Data, and Information Service, National Climatic Data Center, 2009.

SERCC, 2009. Southeast Regional Climate Center, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-3220, Website: http://www.sercc.com/ and http://www.sercc.com/climateinfo/historical/historical_md.html, Date accessed: August 21, 2009.

FSAR Section 2.3.1 will be supplemented with Table 2.3-136 below in a future COLA revision:

Table 2.3-136 – {Tropical Cyclone-Related Extreme Rainfall Events}

Location	Precipitation in (mm)	Storm
Cambridge Water Treatment Plant, MD	10.3 (261.6)	Unnamed September 1935
La Plata, MD	9.8 (248.9)	Doria August 1971
Blackwater Refuge, MD	8.6 (218.4)	Connie August 1955
Annapolis Police Barracks, MD	8.32 (211.3)	Floyd September 1999
Easton Police Barracks, MD	8.26 (209.8)	Unnamed September 1935
Mechanicsville, MD	8.1 (205.7)	Ernesto September 2006
Royal Oak, MD	7.9 (200.7)	Floyd September 1999
Prince Frederick MD	7.43 (188.7)	Connie August 1955
Solomons, MD	7.4 (188.0)	Unnamed September 1935
Preston, MD	7.14 (181.4)	Donna September 1960
Glenn Dale Bell Station, MD	6.98 (177.3)	Connie August 1955
Owings Ferry Landing, MD	6.54 (166.1)	Gloria September 1985
Fort Meade, MD	6.48 (164.6)	Connie August 1955
Waldorf Police Barracks, MD	6.45 (163.8)	Connie August 1955
Washington National Airport, VA	6.11 (155.2)	Agnes June 1972
Crisfield Somers Cove, MD	4.6 (116.8)	Camille August 1969

Note: Table 2.3-136 contains historical tropical cyclone-related extreme rainfall events that have occurred within the site area over a period of record from 1851 through 2008 identified using information from (NOAA, 2009a), (NOAA, 2009b), (SERCC, 2009).

COLA, Part 3, Environmental Report, Section 2.7.3.2 will be revised as follows in a future COLA revision:

2.7.3.2 Hurricanes and Tropical Storms

~~On September 1, 2006, the remnants of Tropical Storm Ernesto dropped between 7 and 10 in (18 to 28 cm) of rain in Calvert County. On July 3, 2003, the remnants of Tropical Storm Bill dropped over 2 in (5.1 cm) of rain in parts of Calvert County. On June 15, 2001, the remnants of Tropical Storm Allison dropped between 1.5 to 3.5 in (3.8 to 8.9 cm) of rain on Calvert County (USDC, 2007b).~~

Historical tropical cyclone-related extreme rainfall events that have occurred within the site area over a period of record from 1851 through 2008 were identified using information from (NOAA, 2009a), (NOAA, 2009b), (SERCC, 2009). These events are presented in Table 2.7-126.

The maximum tropical cyclone-related extreme rainfall event was 10.3 in (261.6 mm) at the Cambridge Water Treatment Plant, MD, in September 1935 from an unnamed storm. The second-highest event was 9.8 in (248.9 mm) at La Plata, MD, in August 1971 from Doria. The third-highest event was 8.6 in (218.4 mm) at Blackwater Refuge, MD, in August 1995 from Connie.

COLA, Part 3, Environmental Report, Section 2.7.8 will be supplemented as follows in a future COLA revision:

2.7.8 References

NOAA, 2009b. Surface Summary of the Day data files, TD 3200, National Oceanic and Atmospheric Administration/National Environmental Satellite, Data, and Information Service, National Climatic Data Center, 2009.

SERCC, 2009. Southeast Regional Climate Center, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-3220, Website: http://www.sercc.com/ and http://www.sercc.com/climateinfo/historical/historical_md.html, Date accessed: August 21, 2009.

COLA, Part 3, Environmental Report, Section 2.7 will be supplemented with Table 2.7-126 below in a future COLA revision:

Table 2.7-126 – Tropical Cyclone-Related Extreme Rainfall Events

Location	Precipitation in (mm)	Storm
Cambridge Water Treatment Plant, MD	10.3 (261.6)	Unnamed September 1935
La Plata, MD	9.8 (248.9)	Doria August 1971
Blackwater Refuge, MD	8.6 (218.4)	Connie August 1955
Annapolis Police Barracks, MD	8.32 (211.3)	Floyd September 1999
Easton Police Barracks, MD	8.26 (209.8)	Unnamed September 1935
Mechanicsville, MD	8.1 (205.7)	Ernesto September 2006
Royal Oak, MD	7.9 (200.7)	Floyd September 1999
Prince Frederick MD	7.43 (188.7)	Connie August 1955
Solomons, MD	7.4 (188.0)	Unnamed September 1935
Preston, MD	7.14 (181.4)	Donna September 1960
Glenn Dale Bell Station, MD	6.98 (177.3)	Connie August 1955
Owings Ferry Landing, MD	6.54 (166.1)	Gloria September 1985
Fort Meade, MD	6.48 (164.6)	Connie August 1955
Waldorf Police Barracks, MD	6.45 (163.8)	Connie August 1955
Washington National Airport, VA	6.11 (155.2)	Agnes June 1972
Crisfield Somers Cove, MD	4.6 (116.8)	Camille August 1969

Note: Table 2.7-126 contains historical tropical cyclone-related extreme rainfall events that have occurred within the site area over a period of record from 1851 through 2008 identified using information from (NOAA, 2009a), (NOAA, 2009b), (SERCC, 2009).

RAI No. 142

Question 02.03.01-17

The design-basis winter precipitation load analysis as discussed in FSAR Section 2.3.1.2.2.12 (through Rev. 3, as proposed to be revised in the October 30, 2008 response to RAI No. 02.03.01-5) does not reflect the interim staff guidance in DC/COL-ISG-07, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures," (ISG-07) for assessment of normal and extreme winter precipitation loads.

The Staff agrees with the approach used to determine the pre-adjusted 48-hour probable maximum winter precipitation (PMWP) estimate as discussed in the October 30, 2008 response to RAI No. 02.03.01-5 - that is, by determining the 48-hour value from a plot of the 6-hour, 24-hour, and 72-hour PMWP values provided in HMR No. 53.

However, it appears that the analysis of the 48-hour PMWP component of the extreme winter precipitation load is based on a not well substantiated assumption that only 25% of the 48-hour PMWP total combines with the 100-year return period ground snow load. Justification for this reduction of the estimated 48-hour PMWP value appears to be based on average (as opposed to extreme) temperature and precipitation statistics from a 6-year period of onsite data. Further, the Staff does not consider six years to be a climatologically representative length of record. Therefore, this analysis does not adequately demonstrate that the 48-hour PMWP total could not fall or that only 25% of that amount would combine with the 100-year return period ground snow load.

On December 8, 2008, NRC received a supplemental response to RAI No. 93 (see ML083430811) pertaining to FSAR Section 2.3.1 of the U.S. EPR Design Certification Application (DCA). In RAI No. 93, the NRC asked AREVA to specify and identify the normal and extreme liquid and frozen precipitation events used in the design of the roofs of safety-related structures developed in accordance with ISG-07, and, among other things, to provide a basis for the chosen site parameter values. The staff believes that AREVA's response to RAI No. 93 is in general conformance with ISG-07 and notes that it appears to take into consideration the limiting amount of the 48-hour PMWP that could be held by the roofs of safety-related structures (which is also offered as an alternative in the language of the 1975 Site Analysis Branch Position on Winter Precipitation Loads, as well as the current revision to SRP Section 2.3.1, and re-iterated in ISG-07).

As a result, the design-basis winter precipitation load analysis, as proposed to be revised in the October 30, 2008 response to RAI No. 02.03.01-5, is not consistent with the more recent AREVA response to RAI No. 93 for FSAR Section 2.3.1 of the U.S. EPR DCA.

(a) Therefore, revise FSAR Section 2.3.1.2.2.12 of the COLA by developing site characteristics for normal and extreme winter precipitation roof loads that are consistent with the guidance in ISG-07, or by justifying an alternative. The guidance in ISG-07, with additional clarification, is summarized below

(1) Normal Winter Precipitation Event - to be input to the determination of the normal winter precipitation event roof load. Value selected should be the highest ground-level weight (load, in lbs/ft^2) from among the following:

- 100-year return period snowpack (more appropriately, ground snow load),
- historical maximum snowpack (snow depth),
- 100-year return period snowfall event (2-day snow depth), or
- historical maximum snowfall event in the site region (2-day snow depth).

ISG-07 indicates that an appropriate source for the 100-year return period snowpack is ASCE Standard No. 7-05. The Staff agrees with the applicant's development of the 100-year return period estimate from the 50-year mean recurrence interval snow load based on ASCE 7-05, as discussed in FSAR Section 2.3.1.2.2.12 (through Rev. 3, as proposed to be revised in the October 30, 2008 response to RAI No. 02.03.01-5).

ISG-07 also indicates that an appropriate source for the 100-year return period two-day snowfall event and the historical two-day maximum snowfall event is the National Climatic Data Center's (NCDC's) Snow Climatology website which includes observations from first-order National Weather Service (NWS) stations and NCDC cooperative network observing stations. In determining whether a snowfall event may be reasonably expected to occur at the site, the observations considered should not be limited to those made at only the few first-order National Weather Service (NWS) stations in the site region; nearby NCDC cooperative network stations should also be taken into consideration. Therefore, the applicant should ensure that the types of stations used to characterize the magnitude of maximum two-day snowfall events in the site area is consistent with ISG-07, or justify using an alternative approach. In either case, update COL FSAR Section 2.3.1.2.2.12 accordingly.

Regulatory Guide 1.206, Section C.I.2.3.2.1 calls for "long-term data from nearby reasonably representative locations (e.g., within 50 miles (80 km)) [of the site]". The applicant may wish to consider long-term observations from NCDC cooperative network stations located in Calvert County, Maryland and other nearby Maryland counties such as St. Mary's, Dorchester, and Talbot, which include, among others, Solomons; Patuxent River Naval Air Station; Prince Frederick 1N; Mechanicsville 5NE; Blackwater Refuge; Cambridge 4W; Owings Ferry Landing; Cambridge Water Treatment Plant; and Royal Oak 2SSW.

Finally, ISG-07 identifies appropriate sources of historical maximum snowpack (snow depth) and other snowfall data, including Local Climatological Data (LCD) summaries, the Climatography of the U.S. No. 20 (CLIM20) series, NCDC Daily Surface Data (TD3200/3210), and NCDC's on-line "Storm Events" data base. However, data taken from any one of these sources should be corroborated by data from another source that contains data for the same weather element. Also, the following limitations in the CLIM20 summaries and NCDC "Storm Events" on-line database should be noted:

- snowfall extremes in the CLIM20 series summaries are limited to only the current 30-year normal period (currently 1971-2000); and
- the "Storm Events" on-line data base is not currently populated with observations prior to 1993 (NCDC's hardcopy monthly "Storm Data" report covers the period back to 1959).

Historical snow depth data are also available on NCDC's Snow Climatology web site.

(2) Extreme Frozen Winter Precipitation Event - to be considered, if applicable (i.e., a greater load than contributed by the extreme liquid precipitation event), in the determination of the extreme winter precipitation event roof load. The value selected should be the higher ground-level weight (load, in lbs/ft^2) between:

- the 100-year return period snowfall event (2-day snow depth), and
- the historical maximum snowfall event in the site region (2-day snow depth),

developed as discussed above for these two-day duration events.

(3) Extreme Liquid Winter Precipitation Event - to be considered, if applicable (i.e., a greater load than contributed by the extreme frozen precipitation event), in the determination of the extreme winter precipitation event roof load. This value is the weight (load, in lbs/ft^2) of the 48-hour PMWP that is physically possible over a 10-square mile area at a particular geographical location during those months with the historically highest snowpacks (snow depths), where the pre-adjusted 48-hour PMWP is developed as discussed in the October 30 response to RAI No. 02.03.01-5.

(b) Pursuant to NUREG-0800, SRP Section 2.3.1, Section I (Areas of Review), Item 6, provide cross-references to any FSAR sections that utilize this design basis winter precipitation load information.

Response

FSAR Section 2.3.1.2.2.12 will be revised to reflect the interim staff guidance in DC/COL-ISG-07, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures," (ISG-07) for assessment of normal and extreme winter precipitation loads.

COLA Impact

FSAR Section 2.3.1.2.2.12 will be replaced with the following in a future COLA revision:

<u>ISG-07 (NRC, 2009) clarified the NRC position on identifying winter precipitation events as site characteristics and site parameters for determining normal and extreme winter precipitation loads on the roofs of Seismic Category I structures. The normal winter precipitation event should be the highest ground-level weight (lb/ft^2) among (1) the 100-year return period snowpack, (2) the historical maximum snowpack, (3) the 100-year return period snowfall event, and (4) the historical maximum snowfall event in the site region.</u>

<u>ISG-07 (NRC, 2009) indicates that an appropriate source for the 100-year return period snowpack is the American Society of Civil Engineers (ASCE) Standard No. 7-05, "Minimum Design Loads for Buildings and Other Structures" (ASCE, 2006). Figure 7-1 of (ASCE, 2006) presents a map of the continental United States showing ground snowpack values (lb/ft^2) with a 50-year mean recurrence interval. Table C7-3 of (ASCE, 2006) suggests that 1.22 is a reasonable factor to convert the 50-year value recurrence</u>

interval values to 100-year mean recurrence interval values (i.e., the 50-year value divided by 0.82).

Based on (ASCE, 2006), the 50-year mean recurrence ground snow load in the CCNPP Unit 3 region is 25 lb/ft^2 (122 kg/m^2). The ANSI importance factor described in ASCE/SEI 7-05, "Minimum Design Loads for Buildings and Other Structures" (ASCE, 2006), can be used to adjust the 50-year recurrence ground snow load to a 100-year recurrence ground snow load. Using an importance factor of 1.22, the 100-year mean recurrence ground snow load is 30.5 lb/ft^2 (148.9 kg/m^2).

ISG-07 (NRC, 2009) indicates that an appropriate source for the 100-year return period two-day snowfall event and the historical two-day maximum snowfall event is the National Climatic Data Center (NCDC) Snow Climatology website (NOAA, 2009d), which includes observations from first-order National Weather Service (NWS) stations and NCDC cooperative network observing stations.

Table 2.3-137 presents the 100-year return period and historical maximum 2-day snowfall events from the NCDC Snow Climatology website. Equation 2 from ISG-07 was used to determine ground snow load values from the snowfall events. None of the ground snow load values presented in the table is greater than the 100-year mean recurrence ground snow load value of 30.5 lb/ft^2 (148.9 kg/m^2) determined using (ASCE, 2006).

ISG-07 (NRC, 2009) indicates that appropriate sources for the historical maximum snowpack include Local Climatological Data summaries, the Climatology of the U.S. No. 20 series, NCDC Daily Surface Data (TD3200/3210), and NCDC's on-line Storm Events data base.

Table 2.3-138 presents the highest daily snow depth (snowpack) taken from the (NOAA 2009d), (NOAA, 2009b), and (NOAA, 2009c). These values are used to represent the historical maximum snowpack according to guidance from ISG-07 (NRC, 2009) and were corroborated where possible by data from the other two sources. Two ground snow load values presented in Table 2.3-138 are greater than the 100-year mean recurrence ground snow load value of 30.5 lb/ft^2 (148.9 kg/m^2) determined using (ASCE, 2006). Of these two ground snow load values, the highest, 33.8 lb/ft^2 (164.8 kg/m^2) determined from a maximum snow depth measured at Owings Ferry Landing, MD, and reported in (NOAA 2009d), was not able to be corroborated. Therefore, the second highest value of 32.4 lb/ft^2 (158.2 kg/m^2) will be used as the ground snow load value in the determination of the normal live load on the roof in loading combinations for Seismic Category I structures. This value was determined from a maximum snow depth measured at Blackwater Refuge, MD, reported in (NOAA 2009d), and corroborated with data from (NOAA, 2009b).

The extreme frozen winter precipitation event should be the higher ground-level weight (lb/ft^2) between (1) the 100-year return period snowfall event and (2) the historical maximum snowfall event in the site region. Table 2.3-137 presents these values; the higher ground-level weight is 21.8 lb/ft^2 (106.4 kg/m^2).

The extreme liquid winter precipitation event is defined as the theoretically greatest depth of precipitation (inches of water) for a 48-hour period that is physically possible

over a 25.9-square-kilometer (10-square-mile) area at a particular geographical location during those months with the historically highest snowpacks. This value can be determined from Hydrometeorological Report (HMR) Number 53 (USWB, 1980) by plotting (using a smooth curve) the probable maximum 6-hour, 24-hour, and 72-hour precipitation during the winter months of December through February. The 6-hour, 24-hour, and 72-hour PMWP values are provided in Table 2.3-8. The plot of the probable maximum 6-hour, 24-hour, and 72-hour precipitation is presented in Figure 2.3-222. The 25.9-square-kilometer (10-square-mile) 48-hour PMWP is selected for the site from the plot using the December data since it is more conservative; the value of the 48-hour PMWP is 22.5 inches (571.5 mm).

ISG-07 (NRC, 2009) endorses the guidance provided in ASCE 7-05 (ASCE, 2006) for converting the ground snow load due to a normal winter precipitation event to a roof snow load. Using equation 7-1 from ASCE 7-05:

$p_f = 0.7\ C_e\ C_t\ I\ p_g$

where p_f is the roof snow load in lb/ft^2, C_e is the exposure factor, C_t is the thermal factor, I is the importance factor, and p_g is the ground snow load in lb/ft^2. The exposure factor for partially exposed, terrain category C from Table 7-2 of ASCE 7-05 was used (value of 1.0). The thermal factor and the importance factor were both set to unity according to guidance provided in ISG-07. The ground snow load is 32.4 lb/ft^2 (158.2 kg/m^2) determined using (NRC, 2009). Therefore, the roof snow load is:

$p_f = 0.7\ (1.0)\ (1.0)\ (1.0)\ (32.4\ \text{lb/ft}^2) = 22.7\ \text{lb/ft}^2\ (110.8\ \text{kg/m}^2)$

This value is applied as a normal live load on the roof in loading combinations for Seismic Category I structures.

Extreme winter precipitation event roof loads are based on the roof load due to the normal winter precipitation event plus the roof load due to the extreme winter precipitation event. Roof loads due to the extreme winter precipitation event shall be the higher roof load resulting from either the extreme frozen winter precipitation event or the extreme liquid winter precipitation event. Since there are no parapets on the roofs of any of the Seismic Category I structures to impede drainage, the extreme frozen winter precipitation event was chosen as the extreme winter precipitation event.

The ground load for the extreme frozen winter precipitation event is 21.8 lb/ft^2 (106.4 kg/m^2). Using equation 7-1 from ASCE 7-05, the roof snow load due to the extreme winter precipitation event is:

$p_f = 0.7\ (1.0)\ (1.0)\ (1.0)\ (21.8\ \text{lb/ft}^2) = 15.3\ \text{lb/ft}^2\ (74.7\ \text{kg/m}^2)$

Therefore, the extreme winter precipitation live roof load is 22.7 lb/ft^2 + 15.3 lb/ft^2 = 38.0 lb/ft^2 (185.5 kg/m^2). This site-specific extreme winter precipitation live roof load is bounded by the U.S. EPR design value.

FSAR Section 2.3.1.2.3 will be supplemented as follows in a future COLA revision:

2.3.1.2.3 References

NOAA, 2009c. Climatography of the United States No. 20, Monthly Station Climate Summaries, 1971-2000, National Oceanic and Atmospheric Administration/National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Date accessed August 2009.

NOAA, 2009d. United States Snow Climatography, http://www.ncdc.noaa.gov/ussc/index.jsp, National Oceanic and Atmospheric Administration/National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Date accessed August 2009.

NRC, 2009. Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures, 2009.

FSAR Section 2.3.1 will be supplemented with Tables 2.3-137 and 2.3-138 in a future COLA revision:

Table 2.3-137 – {100-Year Return Period and Historical Maximum Snowfall Events}

Site	100-yr 2-day Snowfall in (mm)	Observed Maximum 2-day Snowfall in (mm)	100-yr Snowfall Converted to Ground Snow Load lb/ft^2(kg/m^2) [1]	Observed Maximum Snowfall Converted to Ground Snow Load lb/ft^2(kg/m^2) [1]
Owings Ferry Landing, MD	21.9 (556.3)	26.5 (673.1)	17.1 (83.4)	20.7 (100.9)
La Plata, MD	22.7 (576.6)	24.0 (609.6)	17.7 (86.4)	18.7 (91.4)
Waldorf Police Barrack, MD	21.8 (553.7)	18.0 (457.2)	17.0 (83.0)	14.0 (68.5)
Solomons, MD	17.2 (436.9)	17.5 (444.5)	13.4 (65.5)	13.7 (66.6)
Prince Frederick, MD	18.1 (459.7)	16.0 (406.4)	14.1 (68.9)	12.5 (60.9)
US Naval Academy, MD	24.4 (619.8)	28.0 (711.2)	19.0 (92.9)	21.8 (106.6)
Cambridge, MD	19.5 (495.3)	26.0 (660.4)	15.2 (74.2)	20.3 (99.0)
Roanoke, VA	27.8 (706.1)	24.9 (632.5)	21.7 (105.8)	19.4 (94.8)
Baltimore Airport, MD	25.9 (657.9)	24.2 (614.7)	20.2 (98.6)	18.9 (92.1)
Fort Meade, MD	27.6 (701.0)	23.0 (584.2)	21.5 (105.1)	17.9 (87.6)
Vienna, MD	20.7 (525.8)	22.0 (558.8)	16.1 (78.8)	17.2 (83.8)
Upper Marlboro, MD	23.6 (599.4)	22.0 (558.8)	18.4 (89.8)	17.2 (83.8)
Royal Oak, MD	22.3 (566.4)	20.3 (515.6)	17.4 (84.9)	15.8 (77.3)
Blackwater Refuge, MD	16.8 (426.7)	19.0 (482.6)	13.1 (64.0)	14.8 (72.3)
Washington/National, VA	18.6 (472.4)	16.6 (421.6)	14.5 (70.8)	12.9 (63.2)
Easton Police Barracks, MD	15.8 (401.3)	16.5 (419.1)	12.3 (60.2)	12.9 (62.8)
Washington/Dulles, VA	16.0 (406.4)	15.4 (391.2)	12.5 (60.9)	12.0 (58.6)
Annapolis Water Works, MD	17.0 (431.8)	15.0 (381.0)	13.3 (64.7)	11.7 (57.1)
Mechanicsville, MD	23.0 (584.2)	21.0 (533.4)	17.9 (87.6)	16.4 (80.0)

[1] – Conversion from snowfall to ground snow load accomplished using Equation 2 from ISG-07

Table 2.3-138 – {Highest Daily Snow Depth}

Site	Highest Daily Snow Depth in (mm)	Date	Ground Snow Load lb/ft^2(kg/m^2) [1]
Owings Ferry Landing, MD	34 (864)	10/31/1997	33.8 (164.8)
Blackwater Refuge, MD	33 (838)	2/3/1966	32.4 (158.2)
Upper Marlboro, MD	30 (762)	2/21/1979	28.5 (139.0)
Mechanicsville, MD	29 (737)	2/19/1979	27.2 (132.7)
Waldorf Police Barrack, MD	27 (686)	2/2/1966	24.7 (120.4)
Royal Oak, MD	27 (686)	2/19/1979	24.7 (120.4)
Baltimore Airport, MD	25 (635)	1/13/1996	22.2 (108.5)
Easton Police Barracks, MD	25 (635)	2/2/1966	22.2 (108.5)
La Plata, MD	24 (610)	2/19/1979	21.0 (102.6)
Vienna, MD	24 (610)	2/20/1979	21.0 (102.6)
Solomons, MD	23 (584)	1/30/1966	19.8 (96.8)
Fort Meade, MD	23 (584)	1/30/1966	19.8 (96.8)
Prince Frederick, MD	22 (559)	1/30/1966	18.7 (91.2)
Cambridge, MD	21 (533)	2/19/1979	17.5 (85.6)
Annapolis Water Works, MD	15 (381)	2/3/1961	11.1 (54.1)
US Naval Academy, MD	14 (356)	2/16/1958	10.1 (49.3)

[1] - Conversion from snowfall to ground snow load accomplished using Equation 1 from ISG-07

Question 02.03.01-18

The National Climatic Data Center (NCDC) "Storm Events" on-line data base is not currently populated with observations prior to 1993 for snow storms, although the output header from queries for these severe weather events indicates (incorrectly) that the period of record extends from January 1, 1950 to date. Without that knowledge and with no qualification statement in the text of COL FSAR Section 2.3.1.2.2.10 (Snow Storms), the inference is that no such events occurred prior to the earliest date returned from the query. The staff acknowledges that the text in Section 2.3.1.2.2.10 correctly identifies the range of dates covered by the "Storm Events" query and is consistent with corresponding COL FSAR Table 2.3-7.

However, the staff does not consider the actual period of record (POR) presented to be climatologically representative for these types of events because of the POR's relatively short duration, and, more importantly, because (based on other NCDC records) significant snowfall events have been recorded several times in the site area prior to the earliest date returned by the query. Information on extreme snowfall events in the site area provides context for evaluating whether the data considered in developing the site characteristics for normal and extreme winter precipitation load analyses (in COL FSAR Section 2.3.1.2.2.12) is representative of conditions that might be expected to occur at the site.

(a) The applicant should expand the POR used to characterize the occurrence of snow storm events. The applicant may wish to consider, among others, the following NCDC-based data sources: the NCDC publication "Storm Data", which provides narrative coverage of severe weather events back to January 1959 (Ref. 8 in SRP Section 2.3.1); NCDC Daily Surface Data (TD3200/3210) (Ref. 17 in SRP Section 2.3.1); NCDC Climatography of the United States No. 20 (CLIM20); and Southeast Regional Climate Center Historical Climate Summaries for Maryland for identifying overall maximum observed 24-hour and/or maximum monthly snowfall totals; and the NCDC Climate Atlas of the United States (Ref. 5 in SRP Section 2.3.1) for the general variation of monthly maximum snowfall totals and annual maximum snowfall totals in the site region.

However, the staff cautions that data taken from any one of these sources should be corroborated by data from another source that contains data for the same weather element, making note that the snowfall extremes in the CLIM20 series summaries are limited to only the current 30-year normal period (currently 1971-2000).

(b) Regulatory Guide (RG) 1.206, Section C.I.2.3.2.1 calls for "long-term data from nearby reasonably representative locations (e.g., within 50 miles (80 km)) [of the site]". In determining whether a snowfall event may be reasonably expected to occur at the site, the observations considered should not be limited to those recorded only in Calvert County, Maryland. Therefore, the applicant should expand the area used to characterize the occurrence of snow storm events, consistent with this guidance (i.e., within 50 miles of the site), or justify an alternative size area for the selection of reasonably representative locations for obtaining data. In either case, update COL FSAR Section 2.3.1.2.2.10 and any related table(s) accordingly.

(c) The applicant should also expand the area queried from the on-line NCDC "Storm Events" data base and observations extracted from the NCDC "Storm Data" publication beyond Calvert County, Maryland, consistent with the RG 1.206 guidance (i.e., within 50 miles of the site), or justify an alternative size area. In either case, COL FSAR Section 2.3.1.2.2.10 and any related table(s) should be updated accordingly. The applicant may wish to consider, among others, observations from nearby Maryland counties such as St. Mary's, Dorchester, and Talbot. Furthermore, in expanding the area for identifying any reasonably representative overall maximum 24-hour and monthly snowfall totals from among the NCDC-based data sources identified in part (a) of this question, the applicant should consider nearby NCDC cooperative observing network stations with long-term PORs, including, among others: Solomons; Patuxent River Naval Air Station; Prince Frederick 1N; Mechanicsville 5NE; Blackwater Refuge; Cambridge 4W; Owings Ferry Landing; Cambridge Water Treatment Plant; and Royal Oak 2SSW.

Response

The on-line NCDC "Storm Events" data base was queried using an expanded area as requested by the NRC staff. FSAR Table 2.3-7 and COLA Part 3, Environmental Report, Table 2.7-117 have been updated to present the snow events returned from the data base.

An expanded period of record and additional data sources (NCDC Daily Surface Data (TD3200), NCDC Climatography of the U.S. No. 20, Southeast Regional Climate Center) were used to determine the record 1-day snowfall events within approximately 50 mi (80 km) of the site. The data was corroborated when confirmatory data from the other two sources existed. FSAR Table 2.3-139 and COLA Part 3, Environmental Report, Table 2.7-127 have been updated to present the record 1-day snowfall events.

COLA Impact

FSAR Section 2.3.1.2.2.10 will be updated as follows in a future COLA revision:

2.3.1.2.2.10 Snow Storms

~~Table 2.3-7 presents snow storm events which occurred in Calvert County, Maryland, between December 28, 1993, and December 31, 2006. These data were retrieved from the National Climatic Data Center (NOAA, 2007a). Snow amounts ranged from 1.0 to 16.5 in (25.4 to 419.1 mm).~~

Table 2.3-7 presents snow storm events which occurred within surrounding counties of the site between February 12, 1993, and March 1, 2009. The data was retrieved from the National Climatic Data Center (NOAA, 2009e). Snow amounts observed within approximately 50 mi (80 km) of the site ranged from less than 1.0 to 25.0 in (less than 25.4 to 635.0 mm).

Using an expanded period of record and additional data sources ((NOAA, 2009b), (NOAA, 2009c), (SERCC, 2009)), the record 1-day snowfall events within approximately 50 mi (80 km) of the site were determined. The data was corroborated when confirmatory data from the other two sources existed. The record 1-day snowfall events are presented in Table 2.3-139. The highest 1-day snowfall event was measured on

February 19, 1979, at Owings Ferry Landing, Maryland, with a snowfall of 26.0 in (660.4 mm) and a period of record from 1917 through 1998.

FSAR Section 2.3.1.2.3 will be supplemented as follows in a future COLA revision:

2.3.1.2.3 References

NOAA, 2009e. National Climatic Data Center Storm Events, Website: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms, Date accessed: August 27, 2009.

FSAR Table 2.3-7 will be supplemented with additional expanded area events as follows in a future COLA revision:

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Date	Snow Amount
Allegany, Anne Arundel, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Garrett, Harford, Howard, Inland Worcester, Kent, Maryland Beaches, Montgomery, Northern Baltimore, Prince George's, Queen Anne's, Somerset, Southern Baltimore, St. Mary's, Talbot, Washington, Wicomico	02/12/93	4 to 6 inches (102 to 152 mm) of snow and ice accumulations across north-central and western Maryland.
St. Mary's, Queen Anne's, Prince George's, Dorchester, Calvert, Charles	12/28/93	Heavy Snow
Anne Arundel	12/28/93	Unrecorded
MDZ014	02/04/95	Unrecorded
Caroline, Queen Anne's, Talbot	12/19/95	Freezing rain to sleet and snow.
St. Mary's	01/28/95	4 to 5 inches (102 to 127 mm) of snow accumulation.
Dorchester	1/6/1996	Not recorded.
Caroline, Kent, Queen Anne's, Talbot	01/06/96	Winter storm
Anne Arundel, Charles, Harford, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	01/09/96	4 to 6 inches (102 to 152 mm) of snow.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	01/12/96	4 to 6 inches (102 to 152 mm) of snow accumulation.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Date	Snow Amount
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/02/96	4 to 13 inches (102 to 330 mm) of snow during an early-morning event and an additional 4 to 6 inches (102 to 152 mm) during the day, totaling 12 to 18 inches (305 to 457 mm) across lower southern Maryland. 6 to 9 inches (152 to 229 mm) of snowfall from the Potomac Highlands through the western suburbs of Baltimore and Washington.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/02/96	Unrecorded
Calvert, Charles, Prince George's, St. Mary's	02/02/96	8 to 13 inches (203 to 330 mm) of snow accumulation.
Anne Arundel, Calvert, Carroll, Charles, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	02/16/96	10 to 13 inches (254 to 330 mm) of snowfall on the western shore of Chesapeake Bay. 7 to 11 inches (178 to 279 mm) of snowfall over the immediate suburbs of Washington and Baltimore. 4 to 6 inches (102 to 152 mm) of snowfall over areas of north central Maryland.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/16/96	Not recorded.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	03/01/96	Not recorded.
Anne Arundel, Harford, Prince George's	03/02/96	4 inches (102 mm) of snow accumulation in northern Prince George's and eastern Anne Arundel Counties, with up to 6 inches (152 mm) of snow accumulation in portions of Harford County.
7 MDZ021>025	03/07/96	Not recorded.
Caroline, Cecil, Kent, Queen Anne's, Talbot	1/11/97	1.0 to 1.5 inches (25 to 38 mm) of snow accumulation.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/08/97	1.5 to 2 inches (38 to 51 mm) of snow across Somerset, Wicomico, and Worcester counties. 3 to 4.5 inches (76 to 114 mm) of snow accumulation across Dorchester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/08/97	4 to 8 inches (102 to 203 mm) of heavy, wet snow across central and northern Maryland
Caroline, Kent, Queen Anne's, Talbot	12/23/1998	Cecil County snow accumulations included 4.3 inches (109 mm) in Cecilton and 3.0 inches (76 mm) in Elkton. Farther south snow accumulations were 1.5 inches (38 mm) or less.
Dorchester, Wicomico	1/8/99	Not recorded.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Date	Snow Amount
Anne Arundel, Charles, Howard, Montgomery, Prince George's, Southern Baltimore	1/8/99	5 to 6 inches (127 to 152 mm) of snowfall in Frederick, Washington and Allegany Counties. 4 to 5 inches (102 to 127 mm) of snowfall in Montgomery, Carroll, Howard, Harford, and Baltimore Counties. 2 to 4 inches (51 to 102 mm) of snowfall in Anne Arundel, Prince George's, and Charles Counties.
Dorchester, Inland Worcester, Somerset, Wicomico	03/09/99	2 to 6 inches (51 to 152 mm) of snowfall across portions of the Lower Maryland Eastern Shore. The highest amounts occurred in Dorchester and Wicomico counties. 5 to 6 inches (127 to 152 mm) of snowfall for Cambridge in Dorchester county. 4 to 6 inches (102 to 152 mm) of snowfall for Salisbury and Fruitland in Wicomico county. 4 inches (102 mm) of snowfall for Princess Anne in Somerset county.
Allegany, Anne Arundel, Calvert, Charles, Frederick, Howard, Montgomery, Prince George's, St. Mary's, Washington	03/09/99	6 to 10 inches (152 to 254 mm) of snowfall in Prince George's, Montgomery, and Allegany Counties. 4 to 8 inches (102 to 203 mm) of snowfall across Washington, Southern Frederick, Howard, Anne Arundel, Charles and Calvert Counties. 2 to 5 inches (51 to 127 mm) of snowfall across St. Mary's, Northern Frederick, Carroll, and Southern Baltimore Counties, including Baltimore City. 2 inches (51 mm) or less snowfall across Northern Baltimore County.
Anne Arundel, Charles, Howard, Prince George's	3/14/99	Total snow accumulations included 10 to 12 inches (254 to 305 mm) in Allegany County, 6 to 15 inches (152 to 381 mm) in Washington County, 6 to 12 inches (152 to 305 mm) in Frederick County, 5 to 10 inches (127 to 254 mm)in Carroll County, 4 inches (102 mm) in Howard County, and 2 to 3 inches (51 to 76 mm) in Southern Baltimore County, Northern Anne Arundel County, Prince George's, and Northern Charles Counties.
Dorchester	01/20/00	5 to 7 inches (127 to 178 mm) of snow.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Date	Snow Amount
Allegany, Anne Arundel, Calvert, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	01/20/00	Snowfall totals included 4.7 inches (119 mm) in Westminster, 7.0 inches (178 mm) in Bel Air, 5.0 inches (127 mm) in Baltimore, 7.5 inches (191 mm) in Annapolis, 5.7 inches (145 mm) at BWI, 4.8 inches (122 mm) at Andrews Air Force Base, 3.0 inches (76 mm) at Patuxent River Naval Air Station, 4.0 inches (102 mm) in La Plata, 6.2 inches (157 mm) in Damascus, 8.0 inches (203 mm) in Emmitsburg, 4.1 inches (104 mm) in Hagerstown, 6.5 inches (165 mm) in Cumberland, and 7.7 inches (196 mm) in Frostburg.
Dorchester	01/25/00	9 to 14 inches (229 to 356 mm) of snow.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	01/25/00	Total snowfall included 14.9 inches (378 mm) at BWI, 17.0 inches (432 mm) in Annapolis, 16.5 inches (419 mm) in Hollywood, 14.0 inches (356 mm) in Westminster, 13.5 inches (343 mm) in Oxon Hill, 11.5 inches (292 mm) in Gaithersburg, 12.0 inches (305 mm) in Waldorf, 17.0 inches (432 mm) in Baltimore, 11.5 inches (292 mm) in Columbia, 14.0 inches (356 mm) in Bel Air, 9.0 inches (229 mm) in Frederick, 13.5 inches (343 mm) in Hagerstown, and less than 1 inch (25 mm) in Frostburg and Cumberland.
Calvert, Charles, St. Mary's	01/30/00	A mix of sleet and snow in North Central Maryland, and moderate snowfall from Carroll County westward. Elsewhere 3 to 10 inches (76 to 254 mm) of sleet and snowfall.
St. Mary's	02/12/00	Snowfall totals ranged from 2 to 3 inches (51 to 76 mm) across St. Mary's County.
Allegany, Charles, Harford, Howard, Northern Baltimore, Prince George's, Southern Baltimore	12/19/00	Snowfall totals ranged from 1 to 7 inches (25 to 178 mm) with the highest amounts falling across Frederick and Washington Counties and the smallest accumulations right along the Chesapeake Bay.
Caroline, Queen Anne's, Talbot	12/22/00	Snow accumulations included 2.5 inches (64 mm) in Federalsburg (Caroline County), 2 inches (51 mm) in Centreville (Queen Anne's County) and 1 inch (25 mm) in Easton (Talbot County).
Caroline, Cecil, Kent, Queen Anne's, Talbot	1/5/2001	Snow accumulations were approximately 1 inch (25 mm).
Caroline, Kent, Queen Anne's, Talbot	1/20/01	Snow accumulations from 1 to 6 inches (25 to 152 mm) across the Eastern Shore.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Date	Snow Amount
Dorchester, Inland Worcester, Somerset, Wicomico	02/22/01	3 to 6 inches (76 to 152 mm) of snow across the Lower Maryland Eastern Shore. Specific snow totals include: 5 to 6 inches (127 to 152 mm) at Salisbury Airport in Wicomico county, 6 inches (152 mm) at Cambridge in Dorchester county, 5 inches (127 mm) north of Princess Anne in Somerset county, and 5 inches (127 mm) north of Snow Hill in Worcester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Harford, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	02/22/01	3 to 7 inches (76 to 178 mm) of snowfall.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/03/02	3 to 6 inches (76 to 152 mm) of snow across the Lower Maryland Eastern Shore. Specific higher snow totals include: 6 inches (152 mm) at Crisfield in Somerset county, 5 to 6 inches (127 to 152 mm) in Dorchester county, 6 inches (152 mm) at Pocomoke City in Worcester county, 3 to 5 inches (76 to 127 mm) in Wicomico county, 4 inches (102 mm) at Snow Hill in Worcester county, and 3 to 4 inches (76 to 102 mm) at Ocean City in Worcester county.
St. Mary's, Calvert, Charles	01/03/02	In St. Mary's County, snowfall ranged from 2.5 inches (64 mm) in the northern portion to 6.5 inches (165 mm) in the southern tip. In Charles County, snowfall ranged from 1 to 3 inches (25 to 76 mm) with the heaviest amounts in the extreme southern portion of the county.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/16/03	3 to 5 inches (76 to 127 mm) of snow across the Lower Maryland Eastern Shore. Specific higher snow totals include: 5 inches (127 mm) at Princess Anne in Somerset county, 5 inches (127 mm) at Pocomoke in Worcester county, 4 inches (102 mm) in Dorchester county, and 4 inches (102 mm) in Wicomico county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Howard, Montgomery, Prince George's, St. Mary's, Washington	01/19/02	3 to 5 inches (76 to 127 mm) of snow.
Dorchester, Inland Worcester, Somerset, Wicomico	12/04/02	2 to 5 inches (76 to 127 mm) of snow along with less than 1/4 inch (6 mm) of ice across portions of the Lower Maryland Eastern Shore. Specific snow totals include: 4.5 inches (114 mm) at Cambridge in Dorchester county, 3.5 inches (89 mm) at Salisbury in Wicomico county, 3 inches (76 mm) at Princess Anne in Somerset county, and 2 inches (51 mm) at Snow Hill in Worcester county.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Date	Snow Amount
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	12/05/02	The snow and sleet accumulations ranged from 3 to 5 inches (76 to 127 mm) in this area. In Central Maryland, including the Washington D.C. and Baltimore suburbs, snowfall totals ranged from 6 to 8 inches (152 to 203 mm). 7 to 9 inches (178 to 229 mm) of snowfall accumulation across North Central and Western Maryland.
Anne Arundel, Harford, Howard, Montgomery, Southern Baltimore	12/24/02	2 to 4 inches (51 to 102 mm) of snowfall in Southern Frederick, Southern Carroll, Central Baltimore, Harford, Howard, and Northern Montgomery Counties.
Anne Arundel, Carroll, Harford, Howard, Northern Baltimore, Prince George's, Southern Baltimore, Washington	1/5/03	2 to 5 inches (51 to 127 mm) of snow across Central and Western Maryland
St. Mary's	01/16/03	Snowfall totals ranged from 2 inches (51 mm) in the northern part of the county to just over 5 inches (127 mm) at the southern tip.
Caroline, Cecil, Kent, Queen Anne's, Talbot	1/29/03	Snow accumulations were less than 1 inch (25 mm).
Dorchester	1/30/03	1 inch (25 mm) of snow across portions of Dorchester county.
Dorchester	02/06/03	3 to 7 inches (76 to 178 mm) of snow across Dorchester county. 6.5 inches (165 mm) in Cambridge and 3 inches in Vienna.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	02/06/03	Accumulations ranged from 2 to 4 inches (51 to 102 mm) across Western Maryland and 5 to 8 inches (127 to 203 mm) in Central and Southern Maryland.
Dorchester, Wicomico	2/10/03	0.5 inch to 2 inches (13 to 51 mm) of snow across portions of the Lower Maryland Eastern Shore. 2 inches (51 mm) of snow at Salisbury (SBY).
Caroline, Cecil, Kent, Queen Anne's, Talbot	2/10/03	No accumulation.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	2/15/03	4 to 15 inches (102 to 381 mm) of snow, along with some ice, across the Lower Maryland Eastern Shore. Specific snowfall totals include: 15 inches (381 mm) in the far north portion of Dorchester county, 13 inches (330 mm) at Cambridge in Dorchester county, 10 inches (254 mm) in the southern portion of Dorchester county, 6 inches (152 mm) at Delmar in Wicomico county, 5 to 6 inches (127 to 152 mm) at Ocean City in Worcester county, and 4 inches (102 mm) at Salisbury in Wicomico county.
Caroline, Cecil, Kent, Queen Anne's, Talbot	2/15/03	Trace amounts of snow in Talbot County.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Locations / Counties	Locations / Counties
Caroline, Cecil, Kent, Queen Anne's, Talbot	2/16/03	Specific accumulations include 26.0 inches (660 mm) in Colora (Cecil County)[1], 25.0 inches (635 mm) in Centreville (Queen Anne's County), 23.0 inches (584 mm) in Port Deposit (Cecil County), 22.5 inches (572 mm) in Chestertown (Kent County), 22.0 inches (559 mm) in Galena (Kent County), 20.0 inches (508 mm) in Denton (Caroline County), 19.0 inches (483 mm) in Saint Michaels (Talbot County) and 15.0 inches (381 mm) in Royal Oak (Talbot County).
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/14/03	Across western and north central Maryland, and the Baltimore metropolitan area, accumulations of mainly snow ranged from 20 to 32 inches (508 to 813 mm). The highest amounts occurred across the north and west suburbs of Baltimore where a period of thunder snow produced snowfall rates up to 4 inches (102 mm) per hour on the 16th. Across the east and southeast Maryland suburbs of Washington D.C., accumulations of snow and sleet ranged from 12 to 20 inches (305 to 508 mm). Areas that received mainly sleet during this massive winter storm received accumulations around two thirds less than areas that had all snow, even though they were impacted by the same storm system. As an example, Hollywood (St. Mary's County) recorded 7.5 inches (191 mm) of accumulation (almost all sleet) whereas downtown Baltimore recorded 24 inches (610 mm) of accumulation (all snow).
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/26/03	1 to 7 inches (25 to 178 mm) of snow, along with some sleet and freezing rain, across the Lower Maryland Eastern Shore. Specific snow totals include: 7 inches (178 mm) at Cambridge in Dorchester county, 3 inches (76 mm) at Hurlock in Dorchester county, 2 to 2.5 inches (51 to 64 mm) at Salisbury in Wicomico county, and 1 inch (25 mm) at Ocean City in Worcester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/26/03	A total of 5 to 8 inches (127 to 203 mm) of snow accumulated across Central and Southern Maryland and 2 to 4 inches (51 to 102 mm) in Western Maryland.

[1] Colora is greater than 50 mi (80 km) from the site.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Locations / Counties	Locations / Counties
Caroline, Queen Anne's, Talbot	2/27/03	Specific accumulations included 7.0 inches (178 mm) in Easton (Talbot County), 6.5 inches (165 mm) in Stevensville (Queen Anne's County), 5.5 inches (140 mm) in Denton (Caroline County), 4.0 inches (102 mm) in Rock Hall (Kent County) and 2.5 inches (64 mm) in Elkton and Port Deposit (Cecil County).
Anne Arundel, Calvert, Prince George's	12/04/03	Snow totals averaged 1 to 2 inches (25 to 51 mm).
Caroline, Kent, Queen Anne's, Talbot	12/5/03	Accumulations ranged from 2 inches (51 mm) in Talbot and Caroline Counties to around 12 inches (305 mm) in Cecil County.
Dorchester	12/6/03	1 to 2 inches (25 to 51 mm) of snow fell across portions of the county, with Cambridge reporting as much as 2.5 inches (64 mm).
Anne Arundel, Calvert, Charles, Harford, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore	12/14/03	Snowfall totals across Central and Lower Southern Maryland averaged 1 to 3 inches (25 to 76 mm). Some light ice accumulations were also reported.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	01/17/04	Snow amounts from .25 to 2 inches (6 to 51 mm) across Maryland from Allegany down to St. Mary's County.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/25/04	2 to 4 inches (51 to 102 mm) of snow and sleet fell across portions of the Lower Maryland Eastern Shore. Specific amounts included: 4.3 inches (109 mm) at Princess Anne in Somerset county, 3.8 inches (97 mm) at Salisbury in Wicomico county, 3.8 inches (97 mm) at Snow Hill in Worcester county, and 3 inches (76 mm) at Hurlock in Dorchester county.
Dorchester Calvert, Charles, St. Mary's	01/25/04	3 to 4 inches (76 to 102 mm) of snowfall over Lower Southern Maryland.
Caroline, Cecil, Kent, Queen Anne's, Talbot	01/27/04	Specific accumulations included 4.0 inches (102 mm) in Port Deposit (Cecil County) and Rock Hall (Kent County), 3.5 inches (89 mm) in Elkton (Cecil County), 3.0 inches (76 mm) in Conowingo (Cecil County), 1.5 inches (38 mm) in Chestertown (Kent County), 1.0 inch (25 mm) in Stevensville (Queen Anne's County) and traces in both Cordova (Talbot County) and Greensboro (Caroline County).
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/17/04	0.5 to 2 inches (13 to 51 mm) of snowfall across portions of the Lower Maryland Eastern Shore.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Locations / Counties	Locations / Counties
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	12/19/04	0.5 to 2 inches (13 to 51 mm) of snowfall across the Lower Maryland Eastern Shore. Amounts include 1.5 inch (38 mm) at Princess Anne in Somerset county, 1 inch (25 mm) at Salisbury in Wicomico county and at Snow Hill in Worcester county.
Caroline, Cecil, Kent, Queen Anne's, Talbot	12/19/04	Snowfall accumulations were 1 inch (25 mm) or less; black ice formed on area roadways and walkways.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/19/05	0.5 to 1.5 inches (13 to 38 mm) of snowfall across the Lower Maryland Eastern Shore.
Caroline, Cecil, Kent, Queen Anne's, Talbot	01/19/05	Accumulations averaged 2 inches (51 mm) and that specific amount accumulated in Ridgely (Caroline County), Barclay (Queen Anne's County) and Easton (Talbot County).
Dorchester, Wicomico	1/22/05	A mixture of snow, sleet and freezing rain produced 2 to 4 inches (51 to 102 mm) of snow, and 1/8 to 1/4 of an inch (3 to 6 mm) of ice across portions of the Lower Maryland Eastern Shore.
Caroline, Cecil, Kent, Queen Anne's, Talbot	1/22/05	Specific snowfall accumulations were 9 inches (229 mm) in Elkton (Cecil County), 8 inches (203 mm) in Chestertown (Kent County), 7.5 inches (191 mm) in Port Deposit (Cecil County), 6.3 inches (160 mm) in Stevensville (Queen Anne's County), 6 inches (152 mm) in Denton (Caroline County) and 4.0 inches (102 mm) in Easton (Talbot County).
Caroline, Queen Anne's, Talbot	1/29/05	Snow accumulations averaged 3 inches (76 mm) in the northern part of the Eastern Shore and between 3 and 4 inches (76 to 102 mm) in the southern part of the Eastern Shore. In addition to the snow, southern parts of the Eastern Shore also received some sleet and up to 0.25 inches (6 mm) of ice that accrued onto exposed surfaces
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	1/30/05	A mixture of snow, sleet and freezing rain produced 0.5 to 2 inches (13 to 51 mm) of snow, and around 1/8 of an inch (3 mm) of ice across the Lower Maryland Eastern Shore.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Locations / Counties	Locations / Counties
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	2/24/05	1 to 3 inches (25 to 51 mm) of snow fell across the Lower Maryland Eastern Shore. The highest snow amounts were 3 inches (51 mm) at Fruitland in Wicomico county, 3 inches (51 mm) at Salisbury in Wicomico county, 2.8 inches (71 mm) at Vienna in Dorchester county, 2.5 inches (64 mm) at Cambridge in Dorchester county, 2.3 inches (58 mm) at Deal Island in Somerset county, and 2 inches (51 mm) at Pocomoke City in Worcester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore	2/24/05	Snow totals for this event was 4 to 8 inches (102 to 203 mm).
Caroline, Talbot	2/28/05	Accumulations averaged 1 to 2 inches (25 to 51 mm) in Talbot and Caroline Counties and 3 to 5 inches (76 to 127 mm) elsewhere across the Eastern Shore. Specific accumulations included 5.0 inches (127 mm) in Elkton (Cecil County), 4.7 inches (119 mm) in Stevensville (Queen Anne's County), 4.5 inches (114 mm) in Conowingo (Cecil County), 4.0 inches (102 mm) in Kennedyville (Kent County), 2.0 inches (51 mm) in Goldsboro (Caroline County) and 1.0 inch (25 mm) in Saint Michaels (Talbot County).
Caroline, Cecil, Kent, Queen Anne's, Talbot	3/8/05	Accumulations were less than 1 inch (25 mm) in most places, but a sharp drop in temperatures brought treacherous driving conditions on untreated roadways during the afternoon and evening.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	3/8/05	0.5 to 1 inch (13 to 25 mm) of snowfall across portions of the Lower Maryland Eastern Shore.
Dorchester, Somerset, Wicomico	12/05/05	3 to 6 inches (76 to 152 mm) of snow and sleet across portions of the Lower Maryland Eastern Shore.
Anne Arundel, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Southern Baltimore	12/05/05	Storm total snowfall was between 0 to 4 inches (0 to 102 mm) in some spots.
Calvert, Charles, Prince George's, St. Mary's	12/06/05	Storm total snowfall was between 4 to 6.5 inches (102 to 165 mm).
Anne Arundel, Calvert, Charles, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	12/09/05	Generally, storm total snowfall ranged between 1 to 4 inches (25 to 102 mm), while ice accumulations were two-tenths of an inch (5 mm) or less.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Locations / Counties	Locations / Counties
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/11/06	Storm total snowfall across much of Maryland ranged generally between 8 to 14 inches (203 to 356 mm). Across portions of the northern Washington DC suburbs and the Baltimore suburbs of Maryland, where localized snowfall ranged between 14 to 22 inches (356 to 559 mm). The highest snowfall total occurred at Columbia Hills, MD, in Howard County, where snowfall was 22.5 inches (572 mm).
Dorchester	02/12/06	4 to 7 inches (102 to 178 mm) of snow across Dorchester county.
Caroline, Cecil, Kent, Queen Anne's, Talbot	02/12/06	The Eastern Shore picked up a significant amount of snow, especially locations farther to the north. Some specific amounts include, 15.0 inches (381 mm) in Elkton (Cecil County), 12.0 inches (305 mm) in Tolchester (Kent County), 8.0 inches (203 mm) in Ridgely (Caroline County), and 7.5 inches (191 mm) in Cordova (Talbot County).
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/21/07	0.5 to 1 inch (13 to 25 mm) of snow across portions of the Lower Maryland Eastern Shore
Charles, Prince George's, St. Mary's	01/21/07	Frostburg, MD, reported 3 inches (76 mm) of snow. Total accumulations ranging from 1 to 4 inches (25 to 102 mm) across the region.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/12/07	2 tenths of an inch (5 mm) of ice in Huntingtown, MD. Snow and sleet accumulations ranged from 1 to 9 inches (25 to 229 mm) and ice accumulations ranged from a tenth to three quarters of an inch (3 to 19 mm).
Dorchester, Wicomico	2/6/2007	0.5 inches (13 mm) of snow fell in Cambridge.
Anne Arundel, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Washington	2/6/2007	Snow amounts ranged from 1 to 4 inches (25 to 102 mm) across northern and central Maryland.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/12/07	On 2/12/07 1 to 4 inches (25 to 102 mm) of snow and sleet and between 0.25 and 0.50 inches of ice (6 to 13 mm). 2/13/07 Snow and sleet accumulations ranged from 1 to 9 inches (25 to 229 mm) and ice accumulations ranged from a tenth to three quarters of an inch (3 to 19 mm).
Caroline, Talbot	02/13/07	The most significant sleet and ice accumulations occurred in Cecil County where up to a quarter of an inch (6 mm) of ice downed trees and power lines. Some snow/sleet accumulations included 6.0 inches (152 mm) in the city of Conowingo (Cecil County) and 1.7 inches (43 mm) in Stevensville (Queen Anne's County).

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Locations / Counties	Locations / Counties
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/24/07	Anne Arundel County reported between 3 and 5 inches (76 to 127 mm) of snow.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/24/07	In central and eastern Allegany County reported between 4 and 5 inches (102 to 127 mm) of snow.
Dorchester	02/25/07	3.5 inches (89 mm) of snow fell in Cambridge, 2.5 inches (64 mm) of snow fell in Church Creek, and 1.5 inches (38 mm) of snow fell in Vienna.
Caroline, Cecil, Kent, Queen Anne's, Talbot	02/25/07	Snowfall accumulations averaged 2 to 5 inches (56 to 127 mm) with up to around one quarter of an inch (6 mm) of ice accruing on exposed surfaces in Cecil County. Snowfall accumulations included 4.5 inches (114 mm) in Henderson (Caroline County), 4.0 inches (102 mm) in Rock Hall (Kent County), 3.9 inches (99 mm) in Stevensville (Queen Anne's County), 3.0 inches (76 mm) in St Michaels (Talbot County) and at the Conowingo Dam (Cecil County) and 2.0 inches (51 mm) in Elkton (Cecil County) and Cordova (Talbot County).
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	03/07/07	Linkwood reported 1.5 inches (38 mm) of snow, and Cambridge reported 1.0 inch (25 mm) of snow.
Caroline, Talbot, Queen Anne's	03/07/07	Actual accumulations included 2.8 inches (71 mm) in Denton (Caroline County), 2.0 inches (51 mm) in Easton (Talbot County) and Ridgely (Caroline County), 1.8 inches (46 mm) in Stevensville (Queen Anne's County), 1.0 inches (25 mm) in Elkton (Cecil County) and 0.5 inches (13 mm) in Chestertown (Kent County).
Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Southern Baltimore, Washington	3/7/07	6 to 10 inches (152 to 254 mm) of snow.
Anne Arundel, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Southern Baltimore, Washington	3/16/07	Snowfall amounts ranged from 2 to 10 inches (51 to 254 mm).
Charles, Prince George's	4/6/07	1 to 2 inches of snow (25 to 51 mm).

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Locations / Counties	Locations / Counties
Anne Arundel, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, Washington	12/5/07	Snow amounts ranged from 1 to 3 inches (25 to 76 mm) across lower southern Maryland north into the Washington and southern Baltimore suburbs, and up to 7 inches (178 mm) in far western Allegany County. 3 to 6 inches (76 to 152 mm) of snow across Anne Arundel County. The observer at Baltimore-Washington International Airport (BWI) measured 4.7 inches (119 mm) of snow.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, Washington	01/17/08	3 to 4 inches (76 to 102 mm) of snow in western Allegany County. Significant accumulations of snow and sleet were reported with only a trace of ice.
Caroline, Queen Anne's, Talbot	1/24/08	Accumulations averaged 1 to 2 inches (25 to 51 mm). Specific accumulations included 2.5 inches (64 mm) in Henderson (Caroline County), 1.5 inches (38 mm) in Marydel (Caroline County), 1.4 inches (36 mm) in Trappe (Talbot County), 1.3 inches (33 mm) in Ridgely and Denton (Caroline County), 1.0 inch (25 mm) on the southern part of Kent Island (Queen Anne's County) and 0.5 inches (13 mm) in Saint Michaels (Talbot County).
Dorchester, Wicomico	1/24/08	0.5 to 1 inch (13 to 25 mm) of snow occurred in a few areas. Cambridge and East New Market reported 1.0 inch (25 mm) of snow.
Anne Arundel, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, Washington	2/12/08	Up to 5 inches (127 mm) of snow. Mostly ice was reported further east into the Baltimore Metro and northern Washington DC suburbs.
Dorchester, Inland Worcester	2/14/08	0.5 to 2.5 inches (13 to 64 mm) of snow over portions of the Lower Maryland Eastern Shore. Church Creek reported 2.0 inches (51 mm) of snowfall.
Anne Arundel	2/14/08	1 to 2 inches (25 to 51 mm) of snow in St. Mary's County.
Caroline, Talbot	2/14/08	Snow accumulations were less than 1 inch (25 mm) and ice accretions were minimal.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Northern Baltimore, Prince George's, Southern Baltimore, Washington	02/20/08	Snow amounts ranged from 3 to 5 inches (76 to 127 mm) along and west of the Allegheny Front to 1 to 2 inches (25 to 51 mm) further east across the Baltimore Metro and south across lower southern Maryland.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Northern Baltimore, Prince George's, Southern Baltimore, Washington	02/22/08	1 to 2 inches (25 to 51 mm) across the Baltimore Metro and south across lower southern Maryland.

Table 2.3-7 – {Snow Storm Events ~~in Calvert County~~ within the General Region of the Site}

Locations / Counties	Locations / Counties	Locations / Counties
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/27/09	0.5 to 1 inch (13 to 25 mm) occurred across portions of the county. Cambridge reported 1.0 inch (25 mm). Light snow between 0.5 to 1.5 inches (13 to 38 mm) occurred across portions of the Lower Maryland Eastern Shore.
Charles, St. Mary's	01/27/09	Ice accumulation around one tenth of an inch (3 mm). Snow and sleet accumulation around 2 inches (51 mm) was reported throughout the county.
Dorchester	03/01/09	Snowfall amounts were generally between 4 to 11 inches (102 to 279 mm) across the county. Church Creek reported 11.0 inches (279 mm) of snow. Cambridge reported 6.0 inches (152 mm) of snow.
Calvert, St. Mary's Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Southern Baltimore	03/01/09	Snowfall totaled up to 13.0 inches (330 mm) in Port Republic. Snowfall amounts averaged between 6 and 10 inches (152 to 254 mm) across the rest of St. Mary's the county. Snowfall reports throughout northern Baltimore County averaged 5 to 7 inches (127 to 178 mm). Snowfall totals averaged around 2 to 5 inches (51 to 127 mm) across Charles county.

FSAR Section 2.3.1 will be supplemented with Table 2.3-139 below in a future COLA revision:

Table 2.3-139 – {Record 1-Day Snowfall Events within 50 mile (80 km) of the Site}

Location	Record 1-Day Snowfall in (mm)
Owings Ferry Landing, MD	26.0 (660.4)
US Naval Academy, MD	24.0 (609.6)
Cambridge, MD	24.0 (609.6)
Baltimore Airport, MD	22.8 (579.1)
Vienna, MD	22.0 (558.8)
Upper Marlboro, MD	22.0 (558.8)
Mechanicsville, MD	21.0 (533.4)
La Plata, MD	20.0 (508.0)
Royal Oak, MD	20.0 (508.0)
Blackwater Refuge, MD	18.0 (457.2)
Roanoke, VA	16.9 (429.3)
Washington/National, VA	16.4 (416.6)
Fort Meade, MD	16.0 (406.4)
Easton Police Barracks, MD	16.0 (406.4)
Waldorf Police Barrack, MD	15.0 (381.0)
Solomons, MD	15.0 (381.0)
Patuxent River NAS, MD	14.2 (360.7)
Prince Frederick, MD	13.0 (330.2)
Annapolis Water Works, MD	11.5 (292.1)
Washington/Dulles, VA	10.6 (269.2)

Note: Table 2.3-139 contains a summary of corroborated record 1-day snowfall events within approximately 50 mi (80 km) of the site occurring during a period of record from 1917 through 1998. (NOAA, 2009b), (NOAA, 2009c), (SERCC, 2009).

COLA Part 3, Environmental Report, Section 2.7.3.9 will be updated as follows in a future COLA revision:

2.7.3.9 Snow Storms

~~Table 2.7-117 presents snow storm events which occurred in Calvert County between December 28, 1993, and December 31, 2006. These data were retrieved from the National Climatic Data Center (USDC, 2007b). Snow amounts ranged from a trace to 16.5 in (41.9 cm).~~

Table 2.7-117 presents snow storm events which occurred within surrounding counties of the site between February 12, 1993, and March 1, 2009. The data was retrieved from the National Climatic Data Center (NOAA, 2009d). Snow amounts observed within approximately 50 mi (80 km) of the site ranged from less than 1.0 to 25.0 in (less than 25.4 to 635.0 mm).

Using an expanded period of record and additional data sources ((NOAA, 2009b), (NOAA, 2009c), (SERCC, 2009)), the record 1-day snowfall events within approximately 50 mi (80 km) of the site were determined. The data was corroborated when confirmatory data from the other two sources existed. The record 1-day snowfall events are presented in Table 2.7-127. The highest 1-day snowfall event was measured on February 19, 1979, at Owings Ferry Landing, Maryland, with a snowfall of 26.0 in (660.4 mm) and a period of record from 1917 through 1998.

COLA Part 3, Environmental Report, Section 2.7.8 will be supplemented as follows in a future COLA revision:

2.7.8 References

NOAA, 2009d. National Climatic Data Center Storm Events, Website: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms, Date accessed: August 27, 2009.

COLA Part 3, Environmental Report, Table 2.7-117 will be supplemented with additional expanded area events as follows in a future COLA revision:

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Allegany, Anne Arundel, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Garrett, Harford, Howard, Inland Worcester, Kent, Maryland Beaches, Montgomery, Northern Baltimore, Prince George's, Queen Anne's, Somerset, Southern Baltimore, St. Mary's, Talbot, Washington, Wicomico	02/12/93	4 to 6 inches (102 to 152 mm) of snow and ice accumulations across north-central and western Maryland.
St. Mary's, Queen Anne's, Prince George's, Dorchester, Calvert, Charles	12/28/93	Heavy Snow
Anne Arundel	12/28/93	Unrecorded
MDZ014	02/04/95	Unrecorded
Caroline, Queen Anne's, Talbot	12/19/95	Freezing rain to sleet and snow.
St. Mary's	01/28/95	4 to 5 inches (102 to 127 mm) of snow accumulation.
Dorchester	1/6/1996	Not recorded.
Caroline, Kent, Queen Anne's, Talbot	01/06/96	Winter storm
Anne Arundel, Charles, Harford, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	01/09/96	4 to 6 inches (102 to 152 mm) of snow.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	01/12/96	4 to 6 inches (102 to 152 mm) of snow accumulation.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/02/96	4 to 13 inches (102 to 330 mm) of snow during an early-morning event and an additional 4 to 6 inches (102 to 152 mm) during the day, totaling 12 to 18 inches (305 to 457 mm) across lower southern Maryland. 6 to 9 inches (152 to 229 mm) of snowfall from the Potomac Highlands through the western suburbs of Baltimore and Washington.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/02/96	Unrecorded
Calvert, Charles, Prince George's, St. Mary's	02/02/96	8 to 13 inches (203 to 330 mm) of snow accumulation.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Anne Arundel, Calvert, Carroll, Charles, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	02/16/96	10 to 13 inches (254 to 330 mm) of snowfall on the western shore of Chesapeake Bay. 7 to 11 inches (178 to 279 mm) of snowfall over the immediate suburbs of Washington and Baltimore. 4 to 6 inches (102 to 152 mm) of snowfall over areas of north central Maryland.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/16/96	Not recorded.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	03/01/96	Not recorded.
Anne Arundel, Harford, Prince George's	03/02/96	4 inches (102 mm) of snow accumulation in northern Prince George's and eastern Anne Arundel Counties, with up to 6 inches (152 mm) of snow accumulation in portions of Harford County.
7 MDZ021>025	03/07/96	Not recorded.
Caroline, Cecil, Kent, Queen Anne's, Talbot	1/11/97	1.0 to 1.5 inches (25 to 38 mm) of snow accumulation.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/08/97	1.5 to 2 inches (38 to 51 mm) of snow across Somerset, Wicomico, and Worcester counties. 3 to 4.5 inches (76 to 114 mm) of snow accumulation across Dorchester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/08/97	4 to 8 inches (102 to 203 mm) of heavy, wet snow across central and northern Maryland
Caroline, Kent, Queen Anne's, Talbot	12/23/98	Cecil County snow accumulations included 4.3 inches (109 mm) in Cecilton and 3.0 inches (76 mm) in Elkton. Farther south snow accumulations were 1.5 inches (38 mm) or less.
Dorchester, Wicomico	1/8/99	Not recorded.
Anne Arundel, Charles, Howard, Montgomery, Prince George's, Southern Baltimore	1/8/99	5 to 6 inches (127 to 152 mm) of snowfall in Frederick, Washington and Allegany Counties. 4 to 5 inches (102 to 127 mm) of snowfall in Montgomery, Carroll, Howard, Harford, and Baltimore Counties. 2 to 4 inches (51 to 102 mm) of snowfall in Anne Arundel, Prince George's, and Charles Counties.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Dorchester, Inland Worcester, Somerset, Wicomico	03/09/99	2 to 6 inches (51 to 152 mm) of snowfall across portions of the Lower Maryland Eastern Shore. The highest amounts occurred in Dorchester and Wicomico counties. 5 to 6 inches (127 to 152 mm) of snowfall for Cambridge in Dorchester county. 4 to 6 inches (102 to 152 mm) of snowfall for Salisbury and Fruitland in Wicomico county. 4 inches (102 mm) of snowfall for Princess Anne in Somerset county.
Allegany, Anne Arundel, Calvert, Charles, Frederick, Howard, Montgomery, Prince George's, St. Mary's, Washington	03/09/99	6 to 10 inches (152 to 254 mm) of snowfall in Prince George's, Montgomery, and Allegany Counties. 4 to 8 inches (102 to 203 mm) of snowfall across Washington, Southern Frederick, Howard, Anne Arundel, Charles and Calvert Counties. 2 to 5 inches (51 to 127 mm) of snowfall across St. Mary's, Northern Frederick, Carroll, and Southern Baltimore Counties, including Baltimore City. 2 inches (51 mm) or less snowfall across Northern Baltimore County.
Anne Arundel, Charles, Howard, Prince George's	3/14/99	Total snow accumulations included 10 to 12 inches (254 to 305 mm) in Allegany County, 6 to 15 inches (152 to 381 mm) in Washington County, 6 to 12 inches (152 to 305 mm) in Frederick County, 5 to 10 inches (127 to 254 mm)in Carroll County, 4 inches (102 mm) in Howard County, and 2 to 3 inches (51 to 76 mm) in Southern Baltimore County, Northern Anne Arundel County, Prince George's, and Northern Charles Counties.
Dorchester	01/20/00	5 to 7 inches (127 to 178 mm) of snow.
Allegany, Anne Arundel, Calvert, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	01/20/00	Snowfall totals included 4.7 inches (119 mm) in Westminster, 7.0 inches (178 mm) in Bel Air, 5.0 inches (127 mm) in Baltimore, 7.5 inches (191 mm) in Annapolis, 5.7 inches (145 mm) at BWI, 4.8 inches (122 mm) at Andrews Air Force Base, 3.0 inches (76 mm) at Patuxent River Naval Air Station, 4.0 inches (102 mm) in La Plata, 6.2 inches (157 mm) in Damascus, 8.0 inches (203 mm) in Emmitsburg, 4.1 inches (104 mm) in Hagerstown, 6.5 inches (165 mm) in Cumberland, and 7.7 inches (196 mm) in Frostburg.
Dorchester	01/25/00	9 to 14 inches (229 to 356 mm) of snow.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	01/25/00	Total snowfall included 14.9 inches (378 mm) at BWI, 17.0 inches (432 mm) in Annapolis, 16.5 inches (419 mm) in Hollywood, 14.0 inches (356 mm) in Westminster, 13.5 inches (343 mm) in Oxon Hill, 11.5 inches (292 mm) in Gaithersburg, 12.0 inches (305 mm) in Waldorf, 17.0 inches (432 mm) in Baltimore, 11.5 inches (292 mm) in Columbia, 14.0 inches (356 mm) in Bel Air, 9.0 inches (229 mm) in Frederick, 13.5 inches (343 mm) in Hagerstown, and less than 1 inch (25 mm) in Frostburg and Cumberland.
Calvert, Charles, St. Mary's	01/30/00	A mix of sleet and snow in North Central Maryland, and moderate snowfall from Carroll County westward. Elsewhere 3 to 10 inches (76 to 254 mm) of sleet and snowfall.
St. Mary's	02/12/00	Snowfall totals ranged from 2 to 3 inches (51 to 76 mm) across St. Mary's County.
Allegany, Charles, Harford, Howard, Northern Baltimore, Prince George's, Southern Baltimore	12/19/00	Snowfall totals ranged from 1 to 7 inches (25 to 178 mm) with the highest amounts falling across Frederick and Washington Counties and the smallest accumulations right along the Chesapeake Bay.
Caroline, Queen Anne's, Talbot	12/22/00	Snow accumulations included 2.5 inches (64 mm) in Federalsburg (Caroline County), 2 inches (51 mm) in Centreville (Queen Anne's County) and 1 inch (25 mm) in Easton (Talbot County).
Caroline, Cecil, Kent, Queen Anne's, Talbot	1/5/01	Snow accumulations were approximately 1 inch (25 mm).
Caroline, Kent, Queen Anne's, Talbot	1/20/01	Snow accumulations from 1 to 6 inches (25 to 152 mm) across the Eastern Shore.
Dorchester, Inland Worcester, Somerset, Wicomico	02/22/01	3 to 6 inches (76 to 152 mm) of snow across the Lower Maryland Eastern Shore. Specific snow totals include: 5 to 6 inches (127 to 152 mm) at Salisbury Airport in Wicomico county, 6 inches (152 mm) at Cambridge in Dorchester county, 5 inches (127 mm) north of Princess Anne in Somerset county, and 5 inches (127 mm) north of Snow Hill in Worcester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Harford, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	02/22/01	3 to 7 inches (76 to 178 mm) of snowfall.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/03/02	3 to 6 inches (76 to 152 mm) of snow across the Lower Maryland Eastern Shore. Specific higher snow totals include: 6 inches (152 mm) at Crisfield in Somerset county, 5 to 6 inches (127 to 152 mm) in Dorchester county, 6 inches (152 mm) at Pocomoke City in Worcester county, 3 to 5 inches (76 to 127 mm) in Wicomico county, 4 inches (102 mm) at Snow Hill in Worcester county, and 3 to 4 inches (76 to 102 mm) at Ocean City in Worcester county.
St. Mary's, Calvert, Charles	01/03/02	In St. Mary's County, snowfall ranged from 2.5 inches (64 mm) in the northern portion to 6.5 inches (165 mm) in the southern tip. In Charles County, snowfall ranged from 1 to 3 inches (25 to 76 mm) with the heaviest amounts in the extreme southern portion of the county.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/16/03	3 to 5 inches (76 to 127 mm) of snow across the Lower Maryland Eastern Shore. Specific higher snow totals include: 5 inches (127 mm) at Princess Anne in Somerset county, 5 inches (127 mm) at Pocomoke in Worcester county, 4 inches (102 mm) in Dorchester county, and 4 inches (102 mm) in Wicomico county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Howard, Montgomery, Prince George's, St. Mary's, Washington	01/19/02	3 to 5 inches (76 to 127 mm) of snow.
Dorchester, Inland Worcester, Somerset, Wicomico	12/04/02	2 to 5 inches (76 to 127 mm) of snow along with less than 1/4 inch (6 mm) of ice across portions of the Lower Maryland Eastern Shore. Specific snow totals include: 4.5 inches (114 mm) at Cambridge in Dorchester county, 3.5 inches (89 mm) at Salisbury in Wicomico county, 3 inches (76 mm) at Princess Anne in Somerset county, and 2 inches (51 mm) at Snow Hill in Worcester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	12/05/02	The snow and sleet accumulations ranged from 3 to 5 inches (76 to 127 mm) in this area. In Central Maryland, including the Washington D.C. and Baltimore suburbs, snowfall totals ranged from 6 to 8 inches (152 to 203 mm). 7 to 9 inches (178 to 229 mm) of snowfall accumulation across North Central and Western Maryland.
Anne Arundel, Harford, Howard, Montgomery, Southern Baltimore	12/24/02	2 to 4 inches (51 to 102 mm) of snowfall in Southern Frederick, Southern Carroll, Central Baltimore, Harford, Howard, and Northern Montgomery Counties.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Anne Arundel, Carroll, Harford, Howard, Northern Baltimore, Prince George's, Southern Baltimore, Washington	1/5/03	2 to 5 inches (51 to 127 mm) of snow across Central and Western Maryland
St. Mary's	01/16/03	Snowfall totals ranged from 2 inches (51 mm) in the northern part of the county to just over 5 inches (127 mm) at the southern tip.
Caroline, Cecil, Kent, Queen Anne's, Talbot	1/29/03	Snow accumulations were less than 1 inch (25 mm).
Dorchester	1/30/03	1 inch (25 mm) of snow across portions of Dorchester county.
Dorchester	02/06/03	3 to 7 inches (76 to 178 mm) of snow across Dorchester county. 6.5 inches (165 mm) in Cambridge and 3 inches in Vienna.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	02/06/03	Accumulations ranged from 2 to 4 inches (51 to 102 mm) across Western Maryland and 5 to 8 inches (127 to 203 mm) in Central and Southern Maryland.
Dorchester, Wicomico	2/10/03	0.5 inch to 2 inches (13 to 51 mm) of snow across portions of the Lower Maryland Eastern Shore. 2 inches (51 mm) of snow at Salisbury (SBY).
Caroline, Cecil, Kent, Queen Anne's, Talbot	2/10/03	No accumulation.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	2/15/03	4 to 15 inches (102 to 381 mm) of snow, along with some ice, across the Lower Maryland Eastern Shore. Specific snowfall totals include: 15 inches (381 mm) in the far north portion of Dorchester county, 13 inches (330 mm) at Cambridge in Dorchester county, 10 inches (254 mm) in the southern portion of Dorchester county, 6 inches (152 mm) at Delmar in Wicomico county, 5 to 6 inches (127 to 152 mm) at Ocean City in Worcester county, and 4 inches (102 mm) at Salisbury in Wicomico county.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Caroline, Cecil, Kent, Queen Anne's, Talbot	2/15/03	Trace amounts of snow in Talbot County.
Caroline, Cecil, Kent, Queen Anne's, Talbot	2/16/03	Specific accumulations include 26.0 inches (660 mm) in Colora (Cecil County)[1], 25.0 inches (635 mm) in Centreville (Queen Anne's County), 23.0 inches (584 mm) in Port Deposit (Cecil County), 22.5 inches (572 mm) in Chestertown (Kent County), 22.0 inches (559 mm) in Galena (Kent County), 20.0 inches (508 mm) in Denton (Caroline County), 19.0 inches (483 mm) in Saint Michaels (Talbot County) and 15.0 inches (381 mm) in Royal Oak (Talbot County).
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/14/03	Across western and north central Maryland, and the Baltimore metropolitan area, accumulations of mainly snow ranged from 20 to 32 inches (508 to 813 mm). The highest amounts occurred across the north and west suburbs of Baltimore where a period of thunder snow produced snowfall rates up to 4 inches (102 mm) per hour on the 16th. Across the east and southeast Maryland suburbs of Washington D.C., accumulations of snow and sleet ranged from 12 to 20 inches (305 to 508 mm). Areas that received mainly sleet during this massive winter storm received accumulations around two thirds less than areas that had all snow, even though they were impacted by the same storm system. As an example, Hollywood (St. Mary's County) recorded 7.5 inches (191 mm) of accumulation (almost all sleet) whereas downtown Baltimore recorded 24 inches (610 mm) of accumulation (all snow).
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/26/03	1 to 7 inches (25 to 178 mm) of snow, along with some sleet and freezing rain, across the Lower Maryland Eastern Shore. Specific snow totals include: 7 inches (178 mm) at Cambridge in Dorchester county, 3 inches (76 mm) at Hurlock in Dorchester county, 2 to 2.5 inches (51 to 64 mm) at Salisbury in Wicomico county, and 1 inch (25 mm) at Ocean City in Worcester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/26/03	A total of 5 to 8 inches (127 to 203 mm) of snow accumulated across Central and Southern Maryland and 2 to 4 inches (51 to 102 mm) in Western Maryland.

[1] Colora is greater than 50 mi (80 km) from the site.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Caroline, Queen Anne's, Talbot	2/27/03	Specific accumulations included 7.0 inches (178 mm) in Easton (Talbot County), 6.5 inches (165 mm) in Stevensville (Queen Anne's County), 5.5 inches (140 mm) in Denton (Caroline County), 4.0 inches (102 mm) in Rock Hall (Kent County) and 2.5 inches (64 mm) in Elkton and Port Deposit (Cecil County).
Anne Arundel, Calvert, Prince George's	12/04/03	Snow totals averaged 1 to 2 inches (25 to 51 mm).
Caroline, Kent, Queen Anne's, Talbot	12/5/03	Accumulations ranged from 2 inches (51 mm) in Talbot and Caroline Counties to around 12 inches (305 mm) in Cecil County.
Dorchester	12/6/03	1 to 2 inches (25 to 51 mm) of snow fell across portions of the county, with Cambridge reporting as much as 2.5 inches (64 mm).
Anne Arundel, Calvert, Charles, Harford, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore	12/14/03	Snowfall totals across Central and Lower Southern Maryland averaged 1 to 3 inches (25 to 76 mm). Some light ice accumulations were also reported.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	01/17/04	Snow amounts from .25 to 2 inches (6 to 51 mm) across Maryland from Allegany down to St. Mary's County.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/25/04	2 to 4 inches (51 to 102 mm) of snow and sleet fell across portions of the Lower Maryland Eastern Shore. Specific amounts included: 4.3 inches (109 mm) at Princess Anne in Somerset county, 3.8 inches (97 mm) at Salisbury in Wicomico county, 3.8 inches (97 mm) at Snow Hill in Worcester county, and 3 inches (76 mm) at Hurlock in Dorchester county.
Dorchester Calvert, Charles, St. Mary's	01/25/04	3 to 4 inches (76 to 102 mm) of snowfall over Lower Southern Maryland.
Caroline, Cecil, Kent, Queen Anne's, Talbot	01/27/04	Specific accumulations included 4.0 inches (102 mm) in Port Deposit (Cecil County) and Rock Hall (Kent County), 3.5 inches (89 mm) in Elkton (Cecil County), 3.0 inches (76 mm) in Conowingo (Cecil County), 1.5 inches (38 mm) in Chestertown (Kent County), 1.0 inch (25 mm) in Stevensville (Queen Anne's County) and traces in both Cordova (Talbot County) and Greensboro (Caroline County).
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	02/17/04	0.5 to 2 inches (13 to 51 mm) of snowfall across portions of the Lower Maryland Eastern Shore.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	12/19/04	0.5 to 2 inches (13 to 51 mm) of snowfall across the Lower Maryland Eastern Shore. Amounts include 1.5 inch (38 mm) at Princess Anne in Somerset county, 1 inch (25 mm) at Salisbury in Wicomico county and at Snow Hill in Worcester county.
Caroline, Cecil, Kent, Queen Anne's, Talbot	12/19/04	Snowfall accumulations were 1 inch (25 mm) or less; black ice formed on area roadways and walkways.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/19/05	0.5 to 1.5 inches (13 to 38 mm) of snowfall across the Lower Maryland Eastern Shore.
Caroline, Cecil, Kent, Queen Anne's, Talbot	01/19/05	Accumulations averaged 2 inches (51 mm) and that specific amount accumulated in Ridgely (Caroline County), Barclay (Queen Anne's County) and Easton (Talbot County).
Dorchester, Wicomico	1/22/05	A mixture of snow, sleet and freezing rain produced 2 to 4 inches (51 to 102 mm) of snow, and 1/8 to 1/4 of an inch (3 to 6 mm) of ice across portions of the Lower Maryland Eastern Shore.
Caroline, Cecil, Kent, Queen Anne's, Talbot	1/22/05	Specific snowfall accumulations were 9 inches (229 mm) in Elkton (Cecil County), 8 inches (203 mm) in Chestertown (Kent County), 7.5 inches (191 mm) in Port Deposit (Cecil County), 6.3 inches (160 mm) in Stevensville (Queen Anne's County), 6 inches (152 mm) in Denton (Caroline County) and 4.0 inches (102 mm) in Easton (Talbot County).
Caroline, Queen Anne's, Talbot	1/29/05	Snow accumulations averaged 3 inches (76 mm) in the northern part of the Eastern Shore and between 3 and 4 inches (76 to 102 mm) in the southern part of the Eastern Shore. In addition to the snow, southern parts of the Eastern Shore also received some sleet and up to 0.25 inches (6 mm) of ice that accrued onto exposed surfaces
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	1/30/05	A mixture of snow, sleet and freezing rain produced 0.5 to 2 inches (13 to 51 mm) of snow, and around 1/8 of an inch (3 mm) of ice across the Lower Maryland Eastern Shore.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	2/24/05	1 to 3 inches (25 to 51 mm) of snow fell across the Lower Maryland Eastern Shore. The highest snow amounts were 3 inches (51 mm) at Fruitland in Wicomico county, 3 inches (51 mm) at Salisbury in Wicomico county, 2.8 inches (71 mm) at Vienna in Dorchester county, 2.5 inches (64 mm) at Cambridge in Dorchester county, 2.3 inches (58 mm) at Deal Island in Somerset county, and 2 inches (51 mm) at Pocomoke City in Worcester county.
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore	2/24/05	Snow totals for this event was 4 to 8 inches (102 to 203 mm).
Caroline, Talbot	2/28/05	Accumulations averaged 1 to 2 inches (25 to 51 mm) in Talbot and Caroline Counties and 3 to 5 inches (76 to 127 mm) elsewhere across the Eastern Shore. Specific accumulations included 5.0 inches (127 mm) in Elkton (Cecil County), 4.7 inches (119 mm) in Stevensville (Queen Anne's County), 4.5 inches (114 mm) in Conowingo (Cecil County), 4.0 inches (102 mm) in Kennedyville (Kent County), 2.0 inches (51 mm) in Goldsboro (Caroline County) and 1.0 inch (25 mm) in Saint Michaels (Talbot County).
Caroline, Cecil, Kent, Queen Anne's, Talbot	3/8/05	Accumulations were less than 1 inch (25 mm) in most places, but a sharp drop in temperatures brought treacherous driving conditions on untreated roadways during the afternoon and evening.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	3/8/05	0.5 to 1 inch (13 to 25 mm) of snowfall across portions of the Lower Maryland Eastern Shore.
Dorchester, Somerset, Wicomico	12/05/05	3 to 6 inches (76 to 152 mm) of snow and sleet across portions of the Lower Maryland Eastern Shore.
Anne Arundel, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Southern Baltimore	12/05/05	Storm total snowfall was between 0 to 4 inches (0 to 102 mm) in some spots.
Calvert, Charles, Prince George's, St. Mary's	12/06/05	Storm total snowfall was between 4 to 6.5 inches (102 to 165 mm).
Anne Arundel, Calvert, Charles, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's	12/09/05	Generally, storm total snowfall ranged between 1 to 4 inches (25 to 102 mm), while ice accumulations were two-tenths of an inch (5 mm) or less.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/11/06	Storm total snowfall across much of Maryland ranged generally between 8 to 14 inches (203 to 356 mm). Across portions of the northern Washington DC suburbs and the Baltimore suburbs of Maryland, where localized snowfall ranged between 14 to 22 inches (356 to 559 mm). The highest snowfall total occurred at Columbia Hills, MD, in Howard County, where snowfall was 22.5 inches (572 mm).
Dorchester	02/12/06	4 to 7 inches (102 to 178 mm) of snow across Dorchester county.
Caroline, Cecil, Kent, Queen Anne's, Talbot	02/12/06	The Eastern Shore picked up a significant amount of snow, especially locations farther to the north. Some specific amounts include, 15.0 inches (381 mm) in Elkton (Cecil County), 12.0 inches (305 mm) in Tolchester (Kent County), 8.0 inches (203 mm) in Ridgely (Caroline County), and 7.5 inches (191 mm) in Cordova (Talbot County).
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/21/07	0.5 to 1 inch (13 to 25 mm) of snow across portions of the Lower Maryland Eastern Shore
Charles, Prince George's, St. Mary's	01/21/07	Frostburg, MD, reported 3 inches (76 mm) of snow. Total accumulations ranging from 1 to 4 inches (25 to 102 mm) across the region.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/12/07	2 tenths of an inch (5 mm) of ice in Huntingtown, MD. Snow and sleet accumulations ranged from 1 to 9 inches (25 to 229 mm) and ice accumulations ranged from a tenth to three quarters of an inch (3 to 19 mm).
Dorchester, Wicomico	2/6/07	0.5 inches (13 mm) of snow fell in Cambridge.
Anne Arundel, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Washington	2/6/07	Snow amounts ranged from 1 to 4 inches (25 to 102 mm) across northern and central Maryland.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/12/07	On 2/12/07 1 to 4 inches (25 to 102 mm) of snow and sleet and between 0.25 and 0.50 inches of ice (6 to 13 mm). 2/13/07 Snow and sleet accumulations ranged from 1 to 9 inches (25 to 229 mm) and ice accumulations ranged from a tenth to three quarters of an inch (3 to 19 mm).
Caroline, Talbot	02/13/07	The most significant sleet and ice accumulations occurred in Cecil County where up to a quarter of an inch (6 mm) of ice downed trees and power lines. Some snow/sleet accumulations included 6.0 inches (152 mm) in the city of Conowingo (Cecil County) and 1.7 inches (43 mm) in Stevensville (Queen Anne's County).

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/24/07	Anne Arundel County reported between 3 and 5 inches (76 to 127 mm) of snow.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, St. Mary's, Washington	02/24/07	In central and eastern Allegany County reported between 4 and 5 inches (102 to 127 mm) of snow.
Dorchester	02/25/07	3.5 inches (89 mm) of snow fell in Cambridge, 2.5 inches (64 mm) of snow fell in Church Creek, and 1.5 inches (38 mm) of snow fell in Vienna.
Caroline, Cecil, Kent, Queen Anne's, Talbot	02/25/07	Snowfall accumulations averaged 2 to 5 inches (56 to 127 mm) with up to around one quarter of an inch (6 mm) of ice accruing on exposed surfaces in Cecil County. Snowfall accumulations included 4.5 inches (114 mm) in Henderson (Caroline County), 4.0 inches (102 mm) in Rock Hall (Kent County), 3.9 inches (99 mm) in Stevensville (Queen Anne's County), 3.0 inches (76 mm) in St Michaels (Talbot County) and at the Conowingo Dam (Cecil County) and 2.0 inches (51 mm) in Elkton (Cecil County) and Cordova (Talbot County).
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	03/07/07	Linkwood reported 1.5 inches (38 mm) of snow, and Cambridge reported 1.0 inch (25 mm) of snow.
Caroline, Talbot, Queen Anne's	03/07/07	Actual accumulations included 2.8 inches (71 mm) in Denton (Caroline County), 2.0 inches (51 mm) in Easton (Talbot County) and Ridgely (Caroline County), 1.8 inches (46 mm) in Stevensville (Queen Anne's County), 1.0 inches (25 mm) in Elkton (Cecil County) and 0.5 inches (13 mm) in Chestertown (Kent County).
Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Southern Baltimore, Washington	3/7/07	6 to 10 inches (152 to 254 mm) of snow.
Anne Arundel, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Southern Baltimore, Washington	3/16/07	Snowfall amounts ranged from 2 to 10 inches (51 to 254 mm).
Charles, Prince George's	4/6/07	1 to 2 inches of snow (25 to 51 mm).

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Anne Arundel, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, Washington	12/5/07	Snow amounts ranged from 1 to 3 inches (25 to 76 mm) across lower southern Maryland north into the Washington and southern Baltimore suburbs, and up to 7 inches (178 mm) in far western Allegany County. 3 to 6 inches (76 to 152 mm) of snow across Anne Arundel County. The observer at Baltimore-Washington International Airport (BWI) measured 4.7 inches (119 mm) of snow.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, Washington	01/17/08	3 to 4 inches (76 to 102 mm) of snow in western Allegany County. Significant accumulations of snow and sleet were reported with only a trace of ice.
Caroline, Queen Anne's, Talbot	1/24/08	Accumulations averaged 1 to 2 inches (25 to 51 mm). Specific accumulations included 2.5 inches (64 mm) in Henderson (Caroline County), 1.5 inches (38 mm) in Marydel (Caroline County), 1.4 inches (36 mm) in Trappe (Talbot County), 1.3 inches (33 mm) in Ridgely and Denton (Caroline County), 1.0 inch (25 mm) on the southern part of Kent Island (Queen Anne's County) and 0.5 inches (13 mm) in Saint Michaels (Talbot County).
Dorchester, Wicomico	1/24/08	0.5 to 1 inch (13 to 25 mm) of snow occurred in a few areas. Cambridge and East New Market reported 1.0 inch (25 mm) of snow.
Anne Arundel, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince George's, Southern Baltimore, Washington	2/12/08	Up to 5 inches (127 mm) of snow. Mostly ice was reported further east into the Baltimore Metro and northern Washington DC suburbs.
Dorchester, Inland Worcester	2/14/08	0.5 to 2.5 inches (13 to 64 mm) of snow over portions of the Lower Maryland Eastern Shore. Church Creek reported 2.0 inches (51 mm) of snowfall.
Anne Arundel	2/14/08	1 to 2 inches (25 to 51 mm) of snow in St. Mary's County.
Caroline, Talbot	2/14/08	Snow accumulations were less than 1 inch (25 mm) and ice accretions were minimal.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Northern Baltimore, Prince George's, Southern Baltimore, Washington	02/20/08	Snow amounts ranged from 3 to 5 inches (76 to 127 mm) along and west of the Allegheny Front to 1 to 2 inches (25 to 51 mm) further east across the Baltimore Metro and south across lower southern Maryland.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Northern Baltimore, Prince George's, Southern Baltimore, Washington	02/22/08	1 to 2 inches (25 to 51 mm) across the Baltimore Metro and south across lower southern Maryland.

Table 2.7-117 – Snow Storm Events ~~in Calvert County~~ within the General Region of the Site

Locations / Counties	Date	Snow Amount
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	01/27/09	0.5 to 1 inch (13 to 25 mm) occurred across portions of the county. Cambridge reported 1.0 inch (25 mm). Light snow between 0.5 to 1.5 inches (13 to 38 mm) occurred across portions of the Lower Maryland Eastern Shore.
Charles, St. Mary's	01/27/09	Ice accumulation around one tenth of an inch (3 mm). Snow and sleet accumulation around 2 inches (51 mm) was reported throughout the county.
Dorchester	03/01/09	Snowfall amounts were generally between 4 to 11 inches (102 to 279 mm) across the county. Church Creek reported 11.0 inches (279 mm) of snow. Cambridge reported 6.0 inches (152 mm) of snow.
Calvert, St. Mary's Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Southern Baltimore	03/01/09	Snowfall totaled up to 13.0 inches (330 mm) in Port Republic. Snowfall amounts averaged between 6 and 10 inches (152 to 254 mm) across the rest of St. Mary's the county. Snowfall reports throughout northern Baltimore County averaged 5 to 7 inches (127 to 178 mm). Snowfall totals averaged around 2 to 5 inches (51 to 127 mm) across Charles county.

COLA Part 3, Environmental Report, Section 2.7 will be supplemented with Table 2.7-127 below in a future COLA revision:

Table 2.7-127 – Record 1-Day Snowfall Events within 50 mile (80 km) of the Site

Location	Record 1-Day Snowfall in (mm)
Owings Ferry Landing, MD	26.0 (660.4)
US Naval Academy, MD	24.0 (609.6)
Cambridge, MD	24.0 (609.6)
Baltimore Airport, MD	22.8 (579.1)
Vienna, MD	22.0 (558.8)
Upper Marlboro, MD	22.0 (558.8)
Mechanicsville, MD	21.0 (533.4)
La Plata, MD	20.0 (508.0)
Royal Oak, MD	20.0 (508.0)
Blackwater Refuge, MD	18.0 (457.2)
Roanoke, VA	16.9 (429.3)
Washington/National, VA	16.4 (416.6)
Fort Meade, MD	16.0 (406.4)
Easton Police Barracks, MD	16.0 (406.4)
Waldorf Police Barrack, MD	15.0 (381.0)
Solomons, MD	15.0 (381.0)
Patuxent River NAS, MD	14.2 (360.7)
Prince Frederick, MD	13.0 (330.2)
Annapolis Water Works, MD	11.5 (292.1)
Washington/Dulles, VA	10.6 (269.2)

Note: Table 2.7-127 contains a summary of corroborated record 1-day snowfall events within approximately 50 mi (80 km) of the site occurring during a period of record from 1917 through 1998. (NOAA, 2009b), (NOAA, 2009c), (SERCC, 2009).

Question 02.03.01-19

The National Climatic Data Center (NCDC) "Storm Events" on-line data base is not currently populated with observations prior to 1993 for ice storms, although the output header from queries for these severe weather events indicates (incorrectly) that the period of record extends from January 1, 1950 to date. Without that knowledge and with no qualification statement in the text of COL FSAR Section 2.3.1.2.2.9 (Ice Storms), the inference is that no such events occurred prior to the earliest date returned from the query. The staff acknowledges that the text in Section 2.3.1.2.2.9 correctly identifies the range of dates covered by the "Storm Events" query and is consistent with corresponding COL FSAR Table 2.3-6.

However, the staff does not consider the actual period of record (POR) presented to be climatologically representative for these types of events because of the POR's relatively short duration. Information on ice storm events in the site area provides context for evaluating whether the data considered in developing the site characteristics for normal and extreme winter precipitation load analyses (in COL FSAR Section 2.3.1.2.2.12) is representative of conditions that might be expected to occur at the site.

(a) The applicant should expand the POR used to characterize the occurrence of ice storm events. The applicant may wish to consider, among others, the following data sources: the NCDC publication "Storm Data", which provides narrative coverage of severe weather events back to January 1959 (Ref. 8 in SRP Section 2.3.1) and the NCDC Climate Atlas of the United States (Ref. 5 in SRP Section 2.3.1) for the general monthly variation of ice storm events in the site region.

(b) Regulatory Guide (RG) 1.206, Section C.I.2.3.2.1 calls for "long-term data from nearby reasonably representative locations (e.g., within 50 miles (80 km)) [of the site]". In determining whether an ice storm event may be reasonably expected to occur at the site, the observations considered should not be limited to those recorded only in Calvert County, Maryland. Therefore, the applicant should expand the area used to characterize the occurrence of ice storm events, consistent with this guidance (i.e., within 50 miles of the site), or justify an alternative size area for the selection of reasonably representative locations for obtaining data. In either case, update COL FSAR Section 2.3.1.2.2.9 and any related table(s) accordingly.

For ice storm events queried from the on-line NCDC "Storm Events" data base and observations extracted from the NCDC "Storm Data" publication, the applicant may wish to consider, among others, observations from nearby Maryland counties such as St. Mary's, Dorchester, and Talbot Counties. These counties include several nearby NCDC cooperative observing network stations with long-term PORs.

Response

The on-line NCDC "Storm Events" data base was queried using an expanded area and copies of the NCDC Storm Data reports from 1959 through 1992 were used to update the ice storm events as requested by the NRC staff. FSAR Table 2.3-6 and COLA Part 3, Environmental Report, Table 2.7-5 present the updated ice storm events information.

COLA Impact

FSAR Section 2.3.1.2.2.9 will be updated as follows in a future COLA revision:

~~Table 2.3-6 presents five ice storm events which occurred in Calvert County, Maryland, between January 14, 1999, and December 31, 2006. These data were retrieved from the National Climatic Data Center (NOAA, 2007a). Ice thickness ranged from 0.2 to 1 in (5.1 to 25.4 mm). The largest value occurred on January 30, 2000.~~

Table 2.3-6 presents ice storm events which occurred within surrounding counties of the site between January 1959, and January 27, 2009. The data was retrieved from the National Climatic Data Center (NOAA, 2009e) (NOAA, 2009f). Ice thickness observed within approximately 50 mi (80 km) of the site ranged from less than 0.1 to 1.0 in (less than 2.5 to 25.4 mm). The largest values occurred on January 14, 1999, January 30, 2000, and December 11, 2002.

FSAR Section 2.3.1.2.3 will be supplemented as follows in a future COLA revision:

2.3.1.2.3 References

NOAA, 2009f. National Climatic Data Center, Storm Data, Period of Record: 1959-1992.

FSAR Table 2.3-6 will be updated as follows in a future COLA revision:

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Upper Chesapeake Bay	Dec, 1958	Jan, 1959	Up to 24 inches (610 mm) of ice build-up on the Upper Chesapeake Bay.
State	1/20/1959 (AM)	Not Recorded	Freezing Rain, ice thickness not recorded.
State	2/18/1960	2/19/1960	Ice accumulation on roadways associated with large snow storm. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
State	12/24/1961	Not Recorded	Ice accumulation on roadways. Ice thickness not recorded.
Central and Western Maryland	12/9/1962	Not Recorded	Ice accumulation on roadways. Ice thickness not recorded.
State	12/22/1962	Not Recorded	Freezing Rain, ice thickness not recorded.
Central and Western Maryland	12/29/1962	12/31/1962	Ice accumulation on roadways. Ice thickness not recorded.
State	1/1/1964	1/2/1964	Freezing rain followed by sub-freezing temperature resulted in ice accumulation on roadways and walkways. Ice thickness not recorded.
Northern Counties (Greater than 50 mi (80 km) from the site)	1/23/1965	1/24/1965	Freezing rain resulted in ice accumulation of 0.5 to 1 inch (13 to 25 mm) thick.
Western Allegany and Garrett Counties (Greater than 50 mi (80 km) from the site)	3/26/1965	Not Recorded	Ice accumulations of 2 to 4 inches (51 to 102 mm) thick.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Western Mountains (Greater than 50 mi (80 km) from the site)	3/7/1967 (AM)	3/7/1967 (PM)	Ice accumulation up to 1 inch (25 mm) near Thurmont above 1400 ft elevation. Ice accumulation up to 0.5 inches (13 mm) in Garrett County.
Western Maryland (Greater than 50 mi (80 km) from the site)	12/10/1967	12/11/1967	Freezing rain resulted in ice accumulation up to 2 inches (51 mm) thick.
State	1/2/1968 (late PM)	1/3/1968 (AM)	Freezing rain on roadways. Ice thickness not recorded.
State	1/3/1968 (PM)	1/4/1968 (AM)	Freezing rain on roadways. Ice thickness not recorded.
Chesapeake Bay	1/8/1968	1/13/1968	Ice accumulation on Chesapeake Bay. No ice thickness recorded.
Northern Maryland	1/8/1969 (late PM)	1/9/1969 (AM)	Freezing rain on roadways. Ice thickness not recorded.
Upper Chesapeake Bay	1/10/1969	1/16/1969	8 to 10 inches (203 to 254 mm) of ice buildup on Chesapeake Bay, with as much as 14 inches (356 mm) near Tolchester Beach.
State except southern most areas	1/28/1969 (late PM)	1/29/1969 (PM)	Freezing rain. No ice thickness recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Southeast Shore	2/18/1969 (AM)	Not Recorded	Ice accumulation on roadways. Ice thickness not recorded.
Central Eastern Shore	2/2/1970	Not Recorded	Strong winds blew an ice-flow onto shore. Ice thickness not recorded.
Central Maryland, including Eastern Shore	2/14/1970 (AM)	2/16/1970 (AM)	Freezing rain resulting in ice accumulation as thick as 3/8 inch (10 mm)
Central Eastern Shore	2/17/1970	Not Recorded	Freezing rain. No ice thickness recorded.
Garrett County (Greater than 50 mi (80 km) from the site)	12/21/1970 (PM)	12/22/1970 (AM)	Ice storm with ice accumulation as thick as 2 inches (51 mm) in the eastern parts of Garrett County, and as thick as 1 inch (25 mm) in the western parts.
Northern Maryland	1/4/1971 (AM)	Not Recorded	Freezing rain resulting in ice accumulation on roadways. Ice thickness not recorded.
Northern Maryland including Washington D.C.	1/13/1971 (PM)	1/14/1971 (PM)	Thick ice coatings on roadways. No ice thickness recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Northeastern Maryland	1/19/1972 (AM)	Not Recorded	Light rain followed by sub-freezing temperature resulted in thin coating of ice on roadways. Ice thickness not recorded.
Chesapeake Bay	2/2/1971	2/5/1971	Ice buildup as thick as 16 inches (406 mm) on bay.
Western Maryland	2/7/1971	2/8/1971	Winter storm causing icy accumulation on roadways in Western Maryland. Ice thickness not recorded.
Garrett and Allegany Counties	12/13/1973 (AM)	Not Recorded	Icy coating on walkways. Ice thickness not recorded.
State	12/16/1973	12/17/1973	Winter storm causing ice accumulation in areas. Ice thickness not recorded.
Garrett and Allegany Counties	12/1/1974	Not Recorded	Statewide winter storm resulted in ice and snow accumulations. Ice thickness not recorded.
District of Columbia	1/20/1975	Not Recorded	Rain followed by sub-freezing temperatures caused ice accumulation on roadways. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
East Central Maryland	2/1/1975 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Northern Maryland	2/5/1975 (AM)	Not Recorded	Freezing rain. Effects not recorded.
North Elkton, Cecil County	12/8/1975 (6:00 PM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Elkton, Cecil County	12/22/1975 (noon)	Not Recorded	Brief snowfall causing icing on bridge surface. Ice thickness not recorded.
Central and Western Maryland	12/25/1975	12/26/1975	Freezing rain causing ice accumulations. Ice thickness not recorded.
Hartford County	1/1/1976 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Central and Eastern Maryland	1/7/1976 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Southern portions of Eastern Shore, Anne Arundel County and Washington D.C. areas	1/11/1976	1/12/1976	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Upper Chesapeake Bay	1/18/1976	1/24/1976	Ice accumulation on bay as thick as 10 inches (254 mm)

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
State	1/20/1976	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Allegany and Garrett Counties	1/25/1976	1/26/1976	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
State	2/1/1976 (PM)	2/2/1976	Winter storm with freezing rain. No ice accumulation recorded.
Western and North Central Maryland	2/5/1976	2/6/1976	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Frederick County	11/10/1976 (5:30 AM)	11/10/1976 (8:30 AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Eastern Shore	1/4/1977 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
State	1/14/1977	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Upper Chesapeake Bay	1/28/1977 (PM)	Not Recorded	Wind caused large chunks of ice to block Baltimore Harbor. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Western and Central Maryland	11/26/1977	11/27/1977	Freezing conditions resulted in ice accumulations on roadways. Ice thickness not recorded.
Western Maryland	12/6/1977	12/8/1977	Snow and sleet resulted in icy conditions on roadways. Ice thickness not recorded.
State	1/13/1978 (AM)	1/14/1978	Freezing rain causing ice accumulation. Ice thickness not recorded.
State	1/17/1978	1/18/1978	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Western and Northern Maryland	12/19/1978 (PM)	12/20/1978 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
State	1/12/1979 (AM)	1/13/1979 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Western Maryland	1/17/1979	Not Recorded	Freezing rain causing ice accumulation. Ice thickness not recorded.
State	1/20/1979	Not Recorded	Freezing rain causing ice accumulation. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Central and Eastern Shore	2/15/1979	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Central Maryland	2/21/1979 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
North Central and Western Maryland	11/17/1980	11/18/1980	Freezing rain causing ice accumulation. Ice thickness not recorded.
State	12/23/1980 (AM)	Not Recorded	Light rain followed by sub-freezing temperature resulted in coating of ice on roadways. Ice thickness not recorded.
Northeast and Central Maryland	12/1/1981 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Chesapeake Bay	Dec-81	Mar-82	Extensive ice formations on the bay.
North Central	1/3/1982 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways and walkways. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Central and Northern Maryland and the District of Columbia	1/22/1982 (Late PM)	1/23/1982 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness was 0.25 to 0.5 inches (6 to 13 mm).
North Central and Northeastern Maryland	2/1/1982	2/3/1983	Flooding caused large ice chunks to be carried onto roadways, causing blockage. Ice thickness not recorded.
Frederick County (Greater than 50 mi (80 km) from the site)	2/18/1982	2/19/1982	Snow and sleet resulted in 1 to 2 inches (25 to 51 mm) of icy accumulation.
Garrett County	3/6/1982 (7:00 PM)	3/6/1982 (9:00 PM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
North Central Maryland and District of Columbia	1/5/1983 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
North Central Maryland	1/31/1983 (AM)	Not Recorded	Rain followed by sub-freezing temperatures caused ice accumulation on roadways. Ice thickness not recorded.
Garrett and Allegany Counties	12/3/1983 (PM)	12/4/1983 (PM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
State except southeastern and far western counties	12/21/1983 (PM)	12/22/1983 (AM)	Freezing rain causing ice accumulation. Ice thickness not recorded.
Northern Maryland and District of Columbia	12/28/1983 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Central and North Central Maryland and the District of Columbia	1/13/1984 (PM)	1/14/1984 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
North Central and Western Maryland	1/24/1984 (Early AM)	Not Recorded	Light rain followed by sub-freezing temperatures caused ice accumulations on roadways. Ice thickness not recorded.
Frederick, Washington, Allegany and Garrett counties	2/27/1984	2/28/1984 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Central and Western Maryland and Washington D.C.	3/13/1984 (Early AM)	Not Recorded	Freezing rain resulting in 1 to 2 inches (25 to 51 mm) of mixed frozen precipitation.
Baltimore, Hartford, Howard and Prince George's Counties	1/3/1985 (2:00 AM)	1/3/1985 (9:00 AM)	Winter storm caused ice coatings on bridges and elevated roadways. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
State	2/5/1985 (2 PM)	2/6/1985 (12:00 PM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Garrett and Allegany Counties	12/2/1986 (12:00 AM)	12/3/1986 (12:00 AM)	Ice accumulation on trees and power lines. No ice thickness recorded.
District of Columbia	1/18/1987 (5:00 AM)	1/18/1987 (8:00 AM)	Ice covered roads. No ice thickness recorded.
Garrett, Allegany and Washington Counties	2/8/1987 (8:00 PM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Garrett, Allegany, Washington, Frederick, Carroll and Northern Baltimore Counties	11/11/1987 (3:00 AM)	Not Recorded	Winter storm caused ice accumulations. No ice thickness recorded.
Carroll and Hartford Counties and the District of Columbia	3/6/1989 (2:30 AM)	Not Recorded	Winter storm with freezing rain, sleet and snow. Total mixed accumulation of 3 inches (76 mm). Ice thickness not recorded.
Carroll, Northern Baltimore and Hartford Counties	1/4/1990 (5:00 AM)	1/4/1990 (10:00 AM)	Rain and sub-freezing temperatures caused ice accumulation on roadways. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Carroll and Montgomery Counties and the District of Columbia	1/8/1990 (6:00 AM)	1/8/1990 (8:00 PM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Carroll and Montgomery Counties	1/8/1991 (6:00 PM)	1/9/1991 (6:00 AM)	Freezing rain causing ice accumulation on roadways, trees and power lines. Ice thickness not recorded.
Carroll and Northern Baltimore Counties and the District of Columbia	1/10/1991 (6:00 AM)	1/10/1991 (10:00 AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Carroll and Hartford Counties	12/23/1991 (6:00 AM)	12/23/1991 (8:30 AM)	Freezing rain causing ice accumulation on roadways, trees and power lines. Ice thickness not recorded.
Carroll, Hartford, and Cecil Counties	12/28/1991 (12:00 PM)	12/29/1991 (4:00 AM)	Freezing rain causing ice accumulation on roadways, trees and power lines. Ice thickness not recorded.
Frederick, Carroll, Northern Baltimore, Hartford, Cecil and Montgomery Counties and the District of Columbia	1/27/1992 (11:00 PM)	1/28/1992 (12:00 PM)	Freezing rain causing ice accumulation on roadways, trees and power lines. Ice thickness not recorded.
Frederick, Carroll, Northern Baltimore, Hartford, Cecil and Montgomery Counties and the District of Columbia	2/13/1992 (1:00 AM)	2/13/1992 (6:00 PM)	Freezing rain. Ice thickness not recorded.

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Cecil and Montgomery Counties	3/18/1992 (2:00 PM)	3/19/1992 (12:00 AM)	Snow mixed with sleet and freezing rain. No ice thickness reported.
Allegany, Anne Arundel, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Garrett, Harford, Howard, Inland Worcester, Kent, Maryland Beaches, Montgomery, Northern Baltimore, Prince Georges, Queen Annes, Somerset, Southern Baltimore, St. Mary's, Talbot, Washington, Wicomico	2/12/1993 - time not reported	Not Reported	Ice accumulations were reported across north-central and western Maryland; thicknesses were not reported
Anne Arundel, Howard, Montgomery, Prince Georges, Southern Baltimore	29 Jan 1998, 05:00:00 AM EST	29 Jan 1998, 09:00:00 AM EST	Abundant black ice in the Maryland suburbs of Washington, DC and Baltimore
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	23 Dec 1998, 02:00:00 PM EST	25 Dec 1998, 05:00:00 AM EST	0.25 to 0.75 in (6.4 to 19.1 mm)
Anne Arundel, Charles, Howard, Montgomery, Prince Georges, Southern Baltimore	08 Jan 1999, 02:00:00 AM EST	09 Jan 1999, 04:00:00 AM EST	A trace to 0.33 in (8.5 mm) on top of snowfall

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Calvert, Charles, St. Mary's	14 Jan 1999, 01:00:00 AM EST	15 Jan 1999, 11:00:00 AM EST	A trace to 0.25 in (6.4 mm) in Charles, Calvert, and St. Mary's counties, 0.25 to 1 in (6.4 to 25.4 mm) elsewhere across Western and Central Maryland
Dorchester	30 Jan 2000, 07:00:00 AM EST	30 Jan 2000, 11:00:00 PM EST	Up to 0.25 in (6.4 mm) for portions of southern Maryland, including Dorchester county.
Calvert, Charles, St. Mary's	30 Jan 2000, 03:00:00 AM EST	30 Jan 2000, 08:00:00 PM EST	0.25 to 1 in (6.4 to 25.4 mm) in St. Mary's, Charles, and Calvert Counties.
Allegany, Charles, Harford, Howard, Northern Baltimore, Prince Georges	13 Dec 2000, 06:00:00 PM EST	14 Dec 2000, 08:00:00 AM EST	From Carroll and Montgomery Counties westward 0.25 to 0.5 in (6.4 to 12.7 mm)
Dorchester, Inland Worcester, Somerset, Wicomico	04 Dec 2002, 10:00:00 PM EST	05 Dec 2002, 02:30:00 PM EST	Less than 0.25 in (6.4 mm) of ice across portions of the Lower Maryland Eastern Shore.
Anne Arundel, Prince Georges	11 Dec 2002, 12:00:00 AM EST	11 Dec 2002, 09:00:00 AM EST	0.25 to 1 in (6.4 to 25.4 mm)

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Caroline, Cecil, Kent, Queen Annes, Talbot	29 Jan 2003, 03:00:00 AM EST	29 Jan 2003, 06:00:00 PM EST	0.02 in (0.51 mm) to exposed surfaces.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	15 Feb 2003, 04:00:00 PM EST	17 Feb 2003, 04:00:00 PM EST	Some ice, across the Lower Maryland Eastern Shore; thicknesses were not reported
Anne Arundel, Calvert, Charles, Harford, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore	14 Dec 2003, 03:00:00 AM EST	14 Dec 2003, 07:00:00 PM EST	Some light ice accumulations were reported; thicknesses were not recorded
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Northern Baltimore, Prince Georges, Southern Baltimore, St. Mary's, Washington	14 Dec 2003, 03:00:00 AM EST	14 Dec 2003, 07:00:00 PM EST	Up to 0.2 in (5.1 mm)
Anne Arundel, Carroll, Frederick, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, Washington	05 Feb 2004, 05:00:00 PM EST	06 Feb 2004, 08:00:00 PM EST	0.1 to 0.2 in (2.5 to 5.1 mm)
Caroline, Cecil, Kent, Queen Annes, Talbot	19 Dec 2004, 07:00:00 PM EST	20 Dec 2004, 06:00:00 AM EST	Black ice to formed on area roadways and walkways; thicknesses were not reported.
Dorchester, Wicomico	22 Jan 2005, 11:00:00 AM EST	22 Jan 2005, 09:00:00 PM EST	0.13 to 0.25 in (3.2 to 6.4 mm) across portions of the Lower Maryland Eastern Shore

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Caroline, Queen Annes, Talbot	29 Jan 2005, 08:00:00 PM EST	30 Jan 2005, 03:00:00 PM EST	Up to 0.25 in (6.4 mm) on exposed surfaces
Caroline, Queen Annes, Talbot	30 Jan 2005, 12:00:00 AM EST	30 Jan 2005, 05:00:00 PM EST	0.13 in (3.2 mm) across the Lower Maryland Eastern Shore.
Caroline, Queen Annes, Talbot	07 Feb 2005, 08:00:00 PM EST	08 Feb 2005, 06:00:00 AM EST	Black ice formed on untreated roadways across the lower Eastern Shore
Anne Arundel, Calvert, Charles, Harford, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, St. Mary's	09 Dec 2005, 03:00:00 AM EST	09 Dec 2005, 08:00:00 AM EST	0.2 in (5.1 mm) or less.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, St. Mary's, Washington	12 Feb 2007, 22:00:00 PM EST	14 Feb 2007, 12:00:00 PM EST	2/12: 0.5 in (12.7 mm) 2/13: 0.1 to 0.75 in (2.5 to 19.1 mm)
Caroline, Talbot, Cecil	13 Feb 2007, 06:00:00 AM EST	13 Feb 2007, 18:00:00 PM EST	Up to 0.25 in (6.4 mm) in Cecil County
Caroline, Cecil, Kent, Queen Annes, Talbot	26 Feb 2007, 01:00:00 AM EST	25 Feb 2007, 11:00:00 AM EST	Up to 0.25 in (6.4 mm) in Cecil County.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, Washington	17 Jan 2008, 11:00:00 AM EST	17 Jan 2008, 15:00:00 PM EST	A trace of ice

Table 2.3-6 – {Ice Storm Events ~~in Calvert County, Maryland~~ within the General Region of the Site}

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Anne Arundel, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, Washington	12 Feb 2008, 05:00:00 AM EST	13 Feb 2008, 09:00:00 AM EST	Mostly ice was reported east into the Baltimore Metro and northern Washington DC suburbs.
Caroline, Talbot	14 Feb 2008, 00:00:00 AM EST	14 Feb 2008, 03:00:00 AM EST	Ice accretions were minimal.
Caroline, Cecil, Kent, Queen Annes, Talbot	21 Dec 2008, 03:00:00 AM EST	21 Dec 2008, 11:00:00 AM EST	0.2 in. (5.1 mm)
Charles, St. Mary's	27 Jan 2009, 08:00:00 AM EST	28 Jan 2009, 10:00:00 AM EST	0.1 in (2.5 mm)

COLA Part 3, Environmental Report, Section 2.7.3.8 will be updated as follows in a future COLA revision:

~~Table 2.7-5 presents five ice storm events which occurred in Calvert County between January 14, 1999, and December 31, 2006. These data were retrieved from the National Climatic Data Center (USDC, 2007b). Ice thickness ranged from 0.2 to 1 in (0.5 to 2.5 cm). The largest value occurred on January 30, 2000.~~

Table 2.7-5 presents ice storm events which occurred within surrounding counties of the site between January 1959, and January 27, 2009. The data was retrieved from the National Climatic Data Center (NOAA, 2009d) (NOAA, 2009e). Ice thickness observed within approximately 50 mi (80 km) of the site ranged from less than 0.1 to 1.0 in (less than 2.5 to 25.4 mm). The largest values occurred on January 14, 1999, January 30, 2000, and December 11, 2002.

COLA Part 3, Environmental Report, Section 2.7.8 will be supplemented as follows in a future COLA revision:

2.7.8 References

NOAA, 2009e. National Climatic Data Center, Storm Data, Period of Record: 1959-1992.

COLA Part 3, Environmental Report, Table 2.7-5 will be updated as follows in a future COLA revision:

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Upper Chesapeake Bay	Dec, 1958	Jan, 1959	Up to 24 inches (610 mm) of ice build-up on the Upper Chesapeake Bay.
State	1/20/1959 (AM)	Not Recorded	Freezing Rain, ice thickness not recorded.
State	2/18/1960	2/19/1960	Ice accumulation on roadways associated with large snow storm. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
State	12/24/1961	Not Recorded	Ice accumulation on roadways. Ice thickness not recorded.
Central and Western Maryland	12/9/1962	Not Recorded	Ice accumulation on roadways. Ice thickness not recorded.
State	12/22/1962	Not Recorded	Freezing Rain, ice thickness not recorded.
Central and Western Maryland	12/29/1962	12/31/1962	Ice accumulation on roadways. Ice thickness not recorded.
State	1/1/1964	1/2/1964	Freezing rain followed by sub-freezing temperature resulted in ice accumulation on roadways and walkways. Ice thickness not recorded.
Northern Counties (Greater than 50 mi (80 km) from the site)	1/23/1965	1/24/1965	Freezing rain resulted in ice accumulation of 0.5 to 1 inch (13 to 25 mm) thick.
Western Allegany and Garrett Counties (Greater than 50 mi (80 km) from the site)	3/26/1965	Not Recorded	Ice accumulations of 2 to 4 inches (51 to 102 mm) thick.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Western Mountains (Greater than 50 mi (80 km) from the site)	3/7/1967 (AM)	3/7/1967 (PM)	Ice accumulation up to 1 inch (25 mm) near Thurmont above 1400 ft elevation. Ice accumulation up to 0.5 inches (13 mm) in Garrett County.
Western Maryland (Greater than 50 mi (80 km) from the site)	12/10/1967	12/11/1967	Freezing rain resulted in ice accumulation up to 2 inches (51 mm) thick.
State	1/2/1968 (late PM)	1/3/1968 (AM)	Freezing rain on roadways. Ice thickness not recorded.
State	1/3/1968 (PM)	1/4/1968 (AM)	Freezing rain on roadways. Ice thickness not recorded.
Chesapeake Bay	1/8/1968	1/13/1968	Ice accumulation on Chesapeake Bay. No ice thickness recorded.
Northern Maryland	1/8/1969 (late PM)	1/9/1969 (AM)	Freezing rain on roadways. Ice thickness not recorded.
Upper Chesapeake Bay	1/10/1969	1/16/1969	8 to 10 inches (203 to 254 mm) of ice buildup on Chesapeake Bay, with as much as 14 inches (356 mm) near Tolchester Beach.
State except southern most areas	1/28/1969 (late PM)	1/29/1969 (PM)	Freezing rain. No ice thickness recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Southeast Shore	2/18/1969 (AM)	Not Recorded	Ice accumulation on roadways. Ice thickness not recorded.
Central Eastern Shore	2/2/1970	Not Recorded	Strong winds blew an ice-flow onto shore. Ice thickness not recorded.
Central Maryland, including Eastern Shore	2/14/1970 (AM)	2/16/1970 (AM)	Freezing rain resulting in ice accumulation as thick as 3/8 inch (10 mm)
Central Eastern Shore	2/17/1970	Not Recorded	Freezing rain. No ice thickness recorded.
Garrett County (Greater than 50 mi (80 km) from the site)	12/21/1970 (PM)	12/22/1970 (AM)	Ice storm with ice accumulation as thick as 2 inches (51 mm) in the eastern parts of Garrett County, and as thick as 1 inch (25 mm) in the western parts.
Northern Maryland	1/4/1971 (AM)	Not Recorded	Freezing rain resulting in ice accumulation on roadways. Ice thickness not recorded.
Northern Maryland including Washington D.C.	1/13/1971 (PM)	1/14/1971 (PM)	Thick ice coatings on roadways. No ice thickness recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Northeastern Maryland	1/19/1972 (AM)	Not Recorded	Light rain followed by sub-freezing temperature resulted in thin coating of ice on roadways. Ice thickness not recorded.
Chesapeake Bay	2/2/1971	2/5/1971	Ice buildup as thick as 16 inches (406 mm) on bay.
Western Maryland	2/7/1971	2/8/1971	Winter storm causing icy accumulation on roadways in Western Maryland. Ice thickness not recorded.
Garrett and Allegany Counties	12/13/1973 (AM)	Not Recorded	Icy coating on walkways. Ice thickness not recorded.
State	12/16/1973	12/17/1973	Winter storm causing ice accumulation in areas. Ice thickness not recorded.
Garrett and Allegany Counties	12/1/1974	Not Recorded	Statewide winter storm resulted in ice and snow accumulations. Ice thickness not recorded.
District of Columbia	1/20/1975	Not Recorded	Rain followed by sub-freezing temperatures caused ice accumulation on roadways. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
East Central Maryland	2/1/1975 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Northern Maryland	2/5/1975 (AM)	Not Recorded	Freezing rain. Effects not recorded.
North Elkton, Cecil County	12/8/1975 (6:00 PM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Elkton, Cecil County	12/22/1975 (noon)	Not Recorded	Brief snowfall causing icing on bridge surface. Ice thickness not recorded.
Central and Western Maryland	12/25/1975	12/26/1975	Freezing rain causing ice accumulations. Ice thickness not recorded.
Hartford County	1/1/1976 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Central and Eastern Maryland	1/7/1976 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Southern portions of Eastern Shore, Anne Arundel County and Washington D.C. areas	1/11/1976	1/12/1976	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Upper Chesapeake Bay	1/18/1976	1/24/1976	Ice accumulation on bay as thick as 10 inches (254 mm)

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
State	1/20/1976	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Allegany and Garrett Counties	1/25/1976	1/26/1976	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
State	2/1/1976 (PM)	2/2/1976	Winter storm with freezing rain. No ice accumulation recorded.
Western and North Central Maryland	2/5/1976	2/6/1976	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Frederick County	11/10/1976 (5:30 AM)	11/10/1976 (8:30 AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Eastern Shore	1/4/1977 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
State	1/14/1977	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Upper Chesapeake Bay	1/28/1977 (PM)	Not Recorded	Wind caused large chunks of ice to block Baltimore Harbor. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Western and Central Maryland	11/26/1977	11/27/1977	Freezing conditions resulted in ice accumulations on roadways. Ice thickness not recorded.
Western Maryland	12/6/1977	12/8/1977	Snow and sleet resulted in icy conditions on roadways. Ice thickness not recorded.
State	1/13/1978 (AM)	1/14/1978	Freezing rain causing ice accumulation. Ice thickness not recorded.
State	1/17/1978	1/18/1978	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Western and Northern Maryland	12/19/1978 (PM)	12/20/1978 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
State	1/12/1979 (AM)	1/13/1979 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Western Maryland	1/17/1979	Not Recorded	Freezing rain causing ice accumulation. Ice thickness not recorded.
State	1/20/1979	Not Recorded	Freezing rain causing ice accumulation. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Central and Eastern Shore	2/15/1979	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Central Maryland	2/21/1979 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
North Central and Western Maryland	11/17/1980	11/18/1980	Freezing rain causing ice accumulation. Ice thickness not recorded.
State	12/23/1980 (AM)	Not Recorded	Light rain followed by sub-freezing temperature resulted in coating of ice on roadways. Ice thickness not recorded.
Northeast and Central Maryland	12/1/1981 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Chesapeake Bay	Dec-81	Mar-82	Extensive ice formations on the bay.
North Central	1/3/1982 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways and walkways. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Central and Northern Maryland and the District of Columbia	1/22/1982 (Late PM)	1/23/1982 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness was 0.25 to 0.5 inches (6 to 13 mm).
North Central and Northeastern Maryland	2/1/1982	2/3/1983	Flooding caused large ice chunks to be carried onto roadways, causing blockage. Ice thickness not recorded.
Frederick County (Greater than 50 mi (80 km) from the site)	2/18/1982	2/19/1982	Snow and sleet resulted in 1 to 2 inches (25 to 51 mm) of icy accumulation.
Garrett County	3/6/1982 (7:00 PM)	3/6/1982 (9:00 PM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
North Central Maryland and District of Columbia	1/5/1983 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
North Central Maryland	1/31/1983 (AM)	Not Recorded	Rain followed by sub-freezing temperatures caused ice accumulation on roadways. Ice thickness not recorded.
Garrett and Allegany Counties	12/3/1983 (PM)	12/4/1983 (PM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
State except southeastern and far western counties	12/21/1983 (PM)	12/22/1983 (AM)	Freezing rain causing ice accumulation. Ice thickness not recorded.
Northern Maryland and District of Columbia	12/28/1983 (AM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Central and North Central Maryland and the District of Columbia	1/13/1984 (PM)	1/14/1984 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
North Central and Western Maryland	1/24/1984 (Early AM)	Not Recorded	Light rain followed by sub-freezing temperatures caused ice accumulations on roadways. Ice thickness not recorded.
Frederick, Washington, Allegany and Garrett counties	2/27/1984	2/28/1984 (AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Central and Western Maryland and Washington D.C.	3/13/1984 (Early AM)	Not Recorded	Freezing rain resulting in 1 to 2 inches (25 to 51 mm) of mixed frozen precipitation.
Baltimore, Hartford, Howard and Prince George's Counties	1/3/1985 (2:00 AM)	1/3/1985 (9:00 AM)	Winter storm caused ice coatings on bridges and elevated roadways. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
State	2/5/1985 (2 PM)	2/6/1985 (12:00 PM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Garrett and Allegany Counties	12/2/1986 (12:00 AM)	12/3/1986 (12:00 AM)	Ice accumulation on trees and power lines. No ice thickness recorded.
District of Columbia	1/18/1987 (5:00 AM)	1/18/1987 (8:00 AM)	Ice covered roads. No ice thickness recorded.
Garrett, Allegany and Washington Counties	2/8/1987 (8:00 PM)	Not Recorded	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Garrett, Allegany, Washington, Frederick, Carroll and Northern Baltimore Counties	11/11/1987 (3:00 AM)	Not Recorded	Winter storm caused ice accumulations. No ice thickness recorded.
Carroll and Hartford Counties and the District of Columbia	3/6/1989 (2:30 AM)	Not Recorded	Winter storm with freezing rain, sleet and snow. Total mixed accumulation of 3 inches (76 mm). Ice thickness not recorded.
Carroll, Northern Baltimore and Hartford Counties	1/4/1990 (5:00 AM)	1/4/1990 (10:00 AM)	Rain and sub-freezing temperatures caused ice accumulation on roadways. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Carroll and Montgomery Counties and the District of Columbia	1/8/1990 (6:00 AM)	1/8/1990 (8:00 PM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Carroll and Montgomery Counties	1/8/1991 (6:00 PM)	1/9/1991 (6:00 AM)	Freezing rain causing ice accumulation on roadways, trees and power lines. Ice thickness not recorded.
Carroll and Northern Baltimore Counties and the District of Columbia	1/10/1991 (6:00 AM)	1/10/1991 (10:00 AM)	Freezing rain causing ice accumulation on roadways. Ice thickness not recorded.
Carroll and Hartford Counties	12/23/1991 (6:00 AM)	12/23/1991 (8:30 AM)	Freezing rain causing ice accumulation on roadways, trees and power lines. Ice thickness not recorded.
Carroll, Hartford, and Cecil Counties	12/28/1991 (12:00 PM)	12/29/1991 (4:00 AM)	Freezing rain causing ice accumulation on roadways, trees and power lines. Ice thickness not recorded.
Frederick, Carroll, Northern Baltimore, Hartford, Cecil and Montgomery Counties and the District of Columbia	1/27/1992 (11:00 PM)	1/28/1992 (12:00 PM)	Freezing rain causing ice accumulation on roadways, trees and power lines. Ice thickness not recorded.
Frederick, Carroll, Northern Baltimore, Hartford, Cecil and Montgomery Counties and the District of Columbia	2/13/1992 (1:00 AM)	2/13/1992 (6:00 PM)	Freezing rain. Ice thickness not recorded.

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Cecil and Montgomery Counties	3/18/1992 (2:00 PM)	3/19/1992 (12:00 AM)	Snow mixed with sleet and freezing rain. No ice thickness reported.
Allegany, Anne Arundel, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Garrett, Harford, Howard, Inland Worcester, Kent, Maryland Beaches, Montgomery, Northern Baltimore, Prince Georges, Queen Annes, Somerset, Southern Baltimore, St. Mary's, Talbot, Washington, Wicomico	2/12/1993 - time not reported	Not Reported	Ice accumulations were reported across north-central and western Maryland; thicknesses were not reported
Anne Arundel, Howard, Montgomery, Prince Georges, Southern Baltimore	29 Jan 1998, 05:00:00 AM EST	29 Jan 1998, 09:00:00 AM EST	Abundant black ice in the Maryland suburbs of Washington, DC and Baltimore
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	23 Dec 1998, 02:00:00 PM EST	25 Dec 1998, 05:00:00 AM EST	0.25 to 0.75 in (6.4 to 19.1 mm)
Anne Arundel, Charles, Howard, Montgomery, Prince Georges, Southern Baltimore	08 Jan 1999, 02:00:00 AM EST	09 Jan 1999, 04:00:00 AM EST	A trace to 0.33 in (8.5 mm) on top of snowfall

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Calvert, Charles, St. Mary's	14 Jan 1999, 01:00:00 AM EST	15 Jan 1999, 11:00:00 AM EST	A trace to 0.25 in (6.4 mm) in Charles, Calvert, and St. Mary's counties, 0.25 to 1 in (6.4 to 25.4 mm) elsewhere across Western and Central Maryland
Dorchester	30 Jan 2000, 07:00:00 AM EST	30 Jan 2000, 11:00:00 PM EST	Up to 0.25 in (6.4 mm) for portions of southern Maryland, including Dorchester county.
Calvert, Charles, St. Mary's	30 Jan 2000, 03:00:00 AM EST	30 Jan 2000, 08:00:00 PM EST	0.25 to 1 in (6.4 to 25.4 mm) in St. Mary's, Charles, and Calvert Counties.
Allegany, Charles, Harford, Howard, Northern Baltimore, Prince Georges	13 Dec 2000, 06:00:00 PM EST	14 Dec 2000, 08:00:00 AM EST	From Carroll and Montgomery Counties westward 0.25 to 0.5 in (6.4 to 12.7 mm)
Dorchester, Inland Worcester, Somerset, Wicomico	04 Dec 2002, 10:00:00 PM EST	05 Dec 2002, 02:30:00 PM EST	Less than 0.25 in (6.4 mm) of ice across portions of the Lower Maryland Eastern Shore.
Anne Arundel, Prince Georges	11 Dec 2002, 12:00:00 AM EST	11 Dec 2002, 09:00:00 AM EST	0.25 to 1 in (6.4 to 25.4 mm)

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Caroline, Cecil, Kent, Queen Annes, Talbot	29 Jan 2003, 03:00:00 AM EST	29 Jan 2003, 06:00:00 PM EST	0.02 in (0.51 mm) to exposed surfaces.
Dorchester, Inland Worcester, Maryland Beaches, Somerset, Wicomico	15 Feb 2003, 04:00:00 PM EST	17 Feb 2003, 04:00:00 PM EST	Some ice, across the Lower Maryland Eastern Shore; thicknesses were not reported
Anne Arundel, Calvert, Charles, Harford, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore	14 Dec 2003, 03:00:00 AM EST	14 Dec 2003, 07:00:00 PM EST	Some light ice accumulations were reported; thicknesses were not recorded
Allegany, Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Northern Baltimore, Prince Georges, Southern Baltimore, St. Mary's, Washington	14 Dec 2003, 03:00:00 AM EST	14 Dec 2003, 07:00:00 PM EST	Up to 0.2 in (5.1 mm)
Anne Arundel, Carroll, Frederick, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, Washington	05 Feb 2004, 05:00:00 PM EST	06 Feb 2004, 08:00:00 PM EST	0.1 to 0.2 in (2.5 to 5.1 mm)
Caroline, Cecil, Kent, Queen Annes, Talbot	19 Dec 2004, 07:00:00 PM EST	20 Dec 2004, 06:00:00 AM EST	Black ice to formed on area roadways and walkways; thicknesses were not reported.
Dorchester, Wicomico	22 Jan 2005, 11:00:00 AM EST	22 Jan 2005, 09:00:00 PM EST	0.13 to 0.25 in (3.2 to 6.4 mm) across portions of the Lower Maryland Eastern Shore

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Caroline, Queen Annes, Talbot	29 Jan 2005, 08:00:00 PM EST	30 Jan 2005, 03:00:00 PM EST	Up to 0.25 in (6.4 mm) on exposed surfaces
Caroline, Queen Annes, Talbot	30 Jan 2005, 12:00:00 AM EST	30 Jan 2005, 05:00:00 PM EST	0.13 in (3.2 mm) across the Lower Maryland Eastern Shore.
Caroline, Queen Annes, Talbot	07 Feb 2005, 08:00:00 PM EST	08 Feb 2005, 06:00:00 AM EST	Black ice formed on untreated roadways across the lower Eastern Shore
Anne Arundel, Calvert, Charles, Harford, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, St. Mary's	09 Dec 2005, 03:00:00 AM EST	09 Dec 2005, 08:00:00 AM EST	0.2 in (5.1 mm) or less.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, St. Mary's, Washington	12 Feb 2007, 22:00:00 PM EST	14 Feb 2007, 12:00:00 PM EST	2/12: 0.5 in (12.7 mm) 2/13: 0.1 to 0.75 in (2.5 to 19.1 mm)
Caroline, Talbot, Cecil	13 Feb 2007, 06:00:00 AM EST	13 Feb 2007, 18:00:00 PM EST	Up to 0.25 in (6.4 mm) in Cecil County
Caroline, Cecil, Kent, Queen Annes, Talbot	26 Feb 2007, 01:00:00 AM EST	25 Feb 2007, 11:00:00 AM EST	Up to 0.25 in (6.4 mm) in Cecil County.
Anne Arundel, Calvert, Carroll, Charles, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, Washington	17 Jan 2008, 11:00:00 AM EST	17 Jan 2008, 15:00:00 PM EST	A trace of ice

Table 2.7-5 – Ice Storm Events ~~in Calvert County, Maryland~~ within General Region of the Site

Locations/Counties	Start Date and Time	End Date and Time	Ice Thickness
Anne Arundel, Carroll, Frederick, Harford, Howard, Montgomery, Northern Baltimore, Prince Georges, Southern Baltimore, Washington	12 Feb 2008, 05:00:00 AM EST	13 Feb 2008, 09:00:00 AM EST	Mostly ice was reported east into the Baltimore Metro and northern Washington DC suburbs.
Caroline, Talbot	14 Feb 2008, 00:00:00 AM EST	14 Feb 2008, 03:00:00 AM EST	Ice accretions were minimal.
Caroline, Cecil, Kent, Queen Annes, Talbot	21 Dec 2008, 03:00:00 AM EST	21 Dec 2008, 11:00:00 AM EST	0.2 in. (5.1 mm)
Charles, St. Mary's	27 Jan 2009, 08:00:00 AM EST	28 Jan 2009, 10:00:00 AM EST	0.1 in (2.5 mm)

Question 02.03.01-20

The response to RAI No. 02.03.01-9, submitted on October 30, 2008 (see ML083100776) is generally acceptable regarding the proposed specific change to COL FSAR Table 2.0-1. However, the following clarification and corrections are still necessary:

- one additional clarification to the site parameter and site characteristic Importance Factor entries in Table 2.0-1, and;
- one correction to terminology in Table 2.0-1.

(a) Further Clarification of Importance Factor – Both RAI No. 02.03.01-9 and the October 30, 2008 response to it make the distinction between the Importance Factor for wind loads and the design wind speed conversion factor. The former is used to adjust the wind velocity pressure to different annual probabilities of being exceeded (in this case, an importance factor of 1.15 adjusts a 50-year return period value to a 100-year return interval). The latter factor (in this case, 1.07) adjusts the basic wind speed, a 3-second gust value associated with a 50-year recurrence interval, to a 100-year return period.

The site parameter and site characteristic wind speed values in the current version of COL FSAR Table 2.0-1 (Rev. 5) represent 50-year mean recurrence interval values. The 100-year return period wind speed value only appears in COL FSAR Section 2.3.1.2.2.15, presumably in response to the regulatory guidance in NUREG-0800 for SRP Section 2.3.1 (Section 1 (Areas of Review), Item 6 (d)) and in Section C.I.2.3.1.2, Item 4 of Regulatory Guide 1.206. The 100-year return period wind speed value does not appear in Table 2.0-1. Section 2.3.1.2.2.15 also presents the 50- to 100-year return period wind speed conversion factor.

FSAR Section 3.3.1.2 (Determination of Applied Wind Forces) of the U.S. EPR Design Certification Application (Rev. 1) provides the method for estimating the effective wind design velocity pressure using the basic wind speed. The non-tornado wind speed-related information presented in COL FSAR Table 2.0-1 is consistent with that methodology. Therefore, to help avoid confusion, clarify the parenthetical statements that accompany the Table 2.0-1 Importance Factor entries to indicate what this factor is used for (i.e., adjustment of the velocity pressure from a 50-year to a 100-year mean recurrence interval for safety- and quality-related structures).

(b) Correction of Terminology in COL FSAR Table 2.0-1 - The left-hand row designator for the wind-related site parameter and site characteristic entries in Table 2.0-1 (Page 2 of 4) reads "Maximum Sustained Speed". The site parameter and site characteristic values listed in this table represent 3-second gust wind speeds, a fundamentally different statistic. Correct the left-hand row designator to properly indicate the wind speed values being presented.

Response

The parenthetical statements that accompany the Table 2.0-1 Importance Factor will be clarified. The statement "used to adjust the velocity pressure from a 50-year to a 100-year mean recurrence interval for safety- and quality-related structures" will replace the current statement "safety related structures for 100 year mean recurrence interval."

The label "Maximum Sustained Speed" in the left-hand row in Table 2.0-1 will be changed to "ASCE 7-05 Basic Wind Speed (3-second gust)."

COLA Impact

FSAR Table 2.0-1 will be updated as follows in a future COLA revision:

Table 2.0-1 – {U.S. EPR Site Design Envelope Comparison}

	U.S. EPR FSAR Design Parameter Value/Characteristic	CCNPP Unit 3 Design Parameter Value/Characteristic
Wind		
~~Maximum Sustained Speed~~ ASCE 7-05 Basic Wind Speed (3-second gust)	145 mph (Based on 3-sec gust at 33 ft above ground level and factored for 50-yr mean recurrence interval.)	95 mph (based on 3 second gust at 33 feet for 50 year recurrence interval) (See Section 2.3.1)
Importance Factor	1.15 (Safety-related structures for 100-year mean recurrence interval.)	1.15 ~~(safety related structures for 100 year mean recurrence interval)~~ (used to adjust the velocity pressure from a 50-year to a 100-year mean recurrence interval for safety- and quality-related structures) (See Section 2.3.1)