

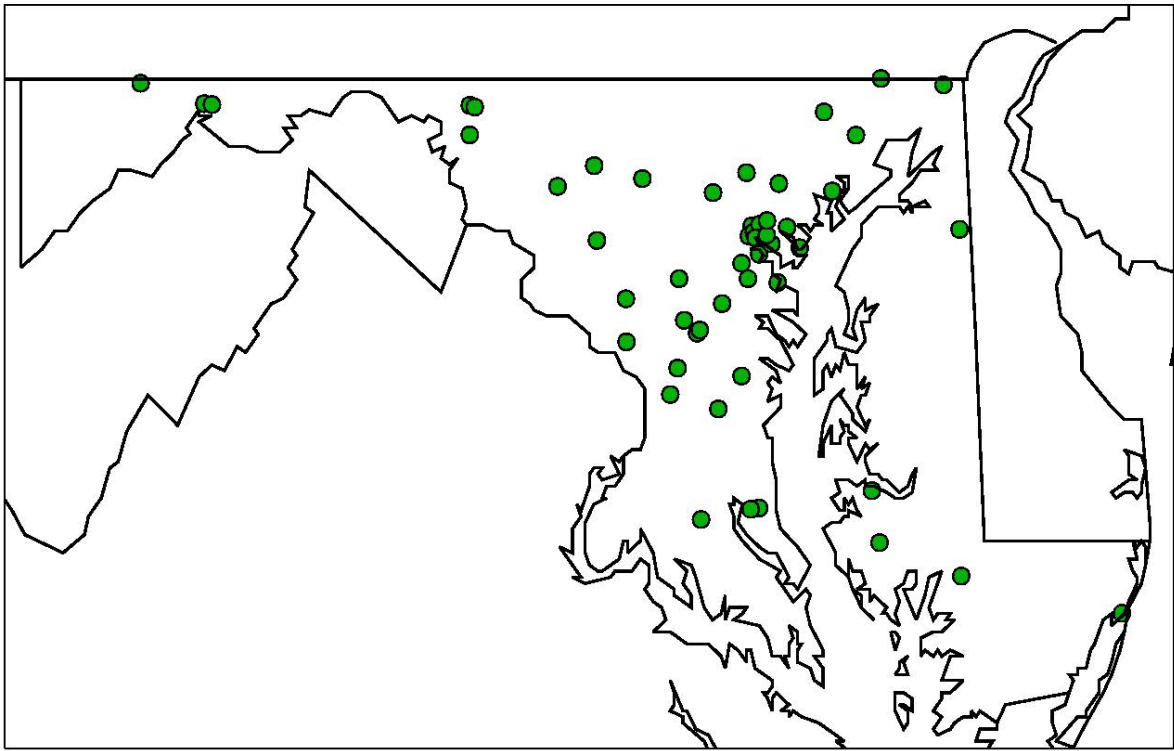
SUPPLEMENTAL MATERIAL

TITLE: “The benefits of air pollution emissions reductions (2002-2011) in the Eastern U.S. during extreme heat”

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Supplemental Material, Figure S1. Map of locations of EPA AQS ozone observations.

Supplemental Material, Table S1. Estimated incidence and valuation results for July 2011 for mortality health endpoints for each states included in the simulation domain and the District of Columbia. 95% Confidence intervals shown in parentheses. Valuation shown in millions of dollars.

	Mortality All Cause		Mortality Non-Accidental			Mortality Cardiopulmonary
	Bell et al.	Levy et al.	Bell et al.	Ito et al.	Schwartz	Huang et al.
Connecticut						
Incidence	12(6-17)	17(12-21)	3(1-5)	15(10-20)	5(2-8)	4(2-7)
Valuation	99.80 (14.20-244.59)	141.00 (21.12-330.75)	28.20 (3.75-71.32)	126.00 (18.76-300.00)	42.80 (5.59-108.80)	40.60 (5.53-101.76)
Washington						
Incidence	4(2-5)	5(4-7)	1(0-1)	5(3-6)	1(0-2)	1(0-2)
Valuation	33.80(4.80-82.75)	47.60 (7.14-111.89)	9.45(1.25-23.89)	42.30(6.28-100.41)	14.40(1.88-36.67)	13.50(1.83-33.74)
Delaware						
Incidence	2(1-3)	3(2-4)	0(0-0)	2(1-3)	0(0-1)	0(0-1)
Valuation	19.00(2.69-46.42)	26.70(4.00-62.77)	5.18(0.68-13.11)	23.20(3.44-55.11)	7.98(1.04-20.29)	7.03(0.95-17.63)
Illinois						
Incidence	39(22-56)	55(40-69)	11(4-17)	49(32-65)	16(7-26)	16(7-24)
Valuation	323.00(45.97-791.81)	456.00(68.37-1070.70)	90.80(12.07-229.55)	407.00(60.38-965.40)	138.00(18.00-350.35)	133.00(18.19-334.45)
Indiana						
Incidence	30(17-43)	43(31-54)	8(3-13)	38(25-50)	12(5-20)	12(6-19)
Valuation	251.00(35.76-615.85)	354.00(53.17-832.64)	70.00(9.30-176.81)	313.00(46.48-742.95)	106.00(13.90-270.44)	104.00(14.16-260.23)
Kentucky						
Incidence	28(16-41)	40(29-50)	7(3-12)	35(23-46)	12(5-18)	11(5-17)
Valuation	236.00(33.54-577.45)	332.00(49.85-780.60)	64.80(8.61-163.67)	290.00(43.00-687.05)	98.70(12.89-250.82)	96.10(13.10-240.75)
Maine						
Incidence	3(1-4)	4(3-5)	0(0-1)	3(2-5)	1(0-2)	1(0-1)
Valuation	25.90(3.67-63.35)	36.50(5.47-85.67)	7.28(0.96-18.40)	32.70(4.84-77.47)	11.00(1.44-28.07)	9.83(1.34-24.64)

Maryland						
Incidence	23(13-34)	33(24-42)	6(2-10)	29(19-39)	10(4-16)	9(4-14)
Valuation	197.00(28.07-483.39)	278.00(41.73-653.56)	54.90(7.30-138.80)	246.00(36.49-583.25)	83.80(10.95-213.06)	78.50(10.70-196.76)
Massachusetts						
Incidence	19(10-27)	26(19-34)	5(2-8)	24(16-32)	8(3-13)	7(3-11)
Valuation	157.00(22.35-385.06)	222.00(33.25-520.72)	44.70(5.94-113.05)	201.00(29.74-475.66)	67.70(8.84-172.14)	62.20(8.47-155.83)
Michigan						
Incidence	33(19-48)	47(35-60)	9(4-14)	42(28-56)	14(6-22)	14(6-21)
Valuation	279.00(39.68-683.58)	393.00(59.03-924.38)	78.30(10.40-197.77)	351.00(52.03-831.88)	119.00(15.55-302.70)	118.00(16.14-296.78)
New Hampshire						
Incidence	3(1-4)	4(3-5)	0(0-1)	3(2-5)	1(0-2)	1(0-1)
Valuation	26.10(3.70-63.83)	36.70(5.51-86.33)	7.30(0.97-18.47)	32.80(4.86-77.75)	11.10(1.44-28.20)	10.30(1.39-25.71)
New Jersey						
Incidence	31(17-45)	44(32-56)	9(3-14)	40(26-53)	13(5-21)	12(6-19)
Valuation	260.00(37.04-638.08)	367.00(55.09-862.78)	74.10(9.85-187.23)	332.00(49.24-787.22)	112.00(14.68-285.81)	106.00(14.41-264.98)
New York						
Incidence	39(22-56)	55(40-70)	11(4-17)	50(33-67)	17(7-26)	17(8-26)
Valuation	324.00(46.08-793.76)	457.00(68.54-1073.38)	92.70(12.32-234.21)	415.00(61.62-985.26)	141.00(18.37-357.46)	146.00(19.89-365.63)
North Carolina						
Incidence	48(27-69)	68(50-86)	13(5-20)	59(39-79)	20(8-32)	18(8-28)
Valuation	399.00(56.70-976.40)	562.00(84.30-1320.04)	110.00(14.59-277.47)	491.00(72.93-1165.51)	168.00(21.90-426.06)	155.00(21.07-387.16)
Ohio						
Incidence	60(33-86)	84(62-107)	16(7-26)	75(50-101)	25(10-40)	24(11-37)
Valuation	496.00(70.56-1215.16)	699.00(104.92-1642.89)	139.00(18.52-352.06)	624.00(92.55-1479.19)	211.00(27.62-537.34)	203.00(27.67-508.52)
Pennsylvania						
Incidence	61(34-88)	86(64-109)	17(7-27)	77(51-103)	26(11-41)	25(12-38)

Valuation	508.00(72.21-1243.66)	716.00(107.39-1681.57)	143.00(19.01-361.49)	641.00(95.06-1519.65)	216.00(28.24-549.56)	209.00(28.51-523.94)
Rhode Island						
Incidence	3(2-5)	5(3-6)	1(0-1)	4(3-6)	1(0-2)	1(0-2)
Valuation	30.60(4.35-75.04)	43.20(6.48-101.47)	8.66(1.15-21.90)	38.80(5.76-92.11)	13.10(1.71-33.27)	12.90(1.76-32.37)
South Carolina						
Incidence	20(11-29)	29(21-36)	5(2-8)	25(16-33)	8(3-13)	7(3-11)
Valuation	170.00(24.14-415.89)	239.00(35.91-562.33)	46.60(6.19-117.80)	209.00(30.97-495.19)	71.40(9.32-181.43)	64.70(8.81-162.05)
Tennessee						
Incidence	38(21-54)	53(39-67)	10(4-16)	46(31-62)	15(6-25)	15(7-23)
Valuation	313.00(44.57-767.50)	442.00(66.26-1037.58)	85.90(11.41-217.00)	384.00(57.02-911.27)	131.00(17.11-332.95)	129.00(17.57-322.75)
Vermont						
Incidence	1(0-1)	1(1-2)	0(0-0)	1(1-2)	0(0-0)	0(0-0)
Valuation	10.80(1.53-26.48)	15.20(2.28-35.81)	3.00(0.39-7.58)	13.50(1.99-31.93)	4.55(0.59-11.56)	4.24(0.57-10.65)
Virginia						
Incidence	34(19-49)	48(35-61)	9(4-14)	42(28-57)	14(6-23)	13(6-20)
Valuation	283.00(40.30-694.11)	399.00(59.93-938.45)	78.70(10.46-198.98)	352.00(52.31-836.08)	120.00(15.69-305.25)	111.00(15.09-277.29)
West Virginia						
Incidence	14(7-20)	20(14-25)	3(1-6)	17(11-23)	5(2-9)	5(2-8)
Valuation	117.00(16.62-286.17)	165.00(24.70-386.85)	32.50(4.31-82.06)	145.00(21.55-344.46)	49.30(6.43-125.21)	47.70(6.50-119.44)
Wisconsin						
Incidence	14(8-20)	20(15-25)	4(1-6)	18(11-24)	6(2-9)	5(2-8)
Valuation	119.00(16.90-291.28)	168.00(25.15-393.92)	33.00(4.39-83.50)	148.00(21.97-351.42)	50.10(6.54-127.39)	47.50(6.47-119.00)

Supplemental Material, Table S2. Estimated incidence and valuation results for July 2011 for shown health endpoints for each states included in the simulation domain and the District of Columbia. 95% Confidence intervals shown in parentheses. Valuation shown in millions of dollars.

State	HA All Respiratory	HA Pneumonia	Emergency Room Visits – Asthma	Minor Restricted Activity Days	Asthma Exacerbation One or More Symptoms
Connecticut					
Incidence	18(1-45)	7(3-11)	17(0-49)	20944(10665-31144)	9827(-6365-22082)
Valuation	0.60(0.05-1.49)	0.20(0.09-0.31)	0.00(-1.15-0.02)	1.38(0.63-2.32)	0.55(-0.35-1.48)
Washington					
Incidence	5(0-14)	2(1-3)	4(0-12)	6644(3386-9871)	3102(-2023-6942)
Valuation	0.19(0.01-0.47)	0.06(0.03-0.09)	0.00(-2.83-0.00)	0.43(0.20-0.73)	0.17(-0.11-0.47)
Delaware					
Incidence	2(0-6)	1(0-1)	2(0-7)	4891(2493-7269)	1597(-1040-3577)
Valuation	0.09(0.00-0.22)	0.03(0.01-0.04)	0.00(-1.78-0.00)	0.32(0.14-0.54)	0.09(-0.05-0.24)
Illinois					
Incidence	61(5-151)	24(11-37)	48(0-137)	66463(33842-98832)	32055(-20759-72039)
Valuation	2.00(0.19-4.95)	0.67(0.32-1.05)	0.02(-3.21-0.05)	4.38(2.01-7.37)	1.80(-1.17-4.85)
Indiana					
Incidence	45(4-111)	17(8-27)	13(0-38)	49408(25196-73392)	24557(-16043-54888)
Valuation	1.47(0.14-3.64)	0.49(0.24-0.77)	0.00(-9.06-0.01)	3.26(1.50-5.47)	1.38(-0.90-3.72)
Kentucky					
Incidence	56(5-138)	24(12-38)	22(0-65)	43731(22333-64889)	20284(-13372-45071)
Valuation	1.82(0.17-4.49)	0.69(0.33-1.08)	0.00(-1.53-0.02)	2.88(1.33-4.84)	1.14(-0.75-3.07)
Maine					
Incidence	5(0-13)	2(1-4)	0(0-0)	4644(2361-6914)	1968(-1263-4448)
Valuation	0.17(0.01-0.42)	0.07(0.03-0.11)	5.75(-8.80-0.00)	0.30(0.14-0.51)	0.11(-0.07-0.29)
Maryland					
Incidence	34(3-84)	12(6-20)	33(0-97)	44804(22848-66552)	20342(-13295-45453)
Valuation	1.12(0.10-2.77)	0.36(0.17-0.57)	0.01(-2.26-0.03)	2.95(1.36-4.96)	1.14(-0.75-3.08)
Massachusetts					
Incidence	33(3-83)	13(6-21)	20(0-57)	32597(16589-48492)	14467(-9341-32572)
Valuation	1.10(0.10-2.74)	0.38(0.18-0.60)	0.00(-1.34-0.02)	2.15(0.98-3.61)	0.81(-0.52-2.19)
Michigan					
Incidence	51(4-127)	18(8-28)	32(0-94)	55135(28074-81989)	26844(-17384-60325)
Valuation	1.68(0.16-4.16)	0.50(0.24-0.79)	0.01(-2.20-0.03)	3.63(1.67-6.11)	1.51(-0.98-4.06)
New Hampshire					
Incidence	4(0-11)	1(0-2)	4(0-12)	5833(2967-8680)	2599(-1673-5863)
Valuation	0.15(0.01-0.37)	0.05(0.02-0.07)	0.00(-3.01-0.00)	0.38(0.17-0.64)	0.14(-0.09-0.39)

New Jersey					
Incidence	47(4-116)	16(7-25)	40(0-115)	53103(27052-78940)	24949(-16205-55964)
Valuation	1.55(0.14-3.84)	0.45(0.22-0.71)	0.01(-2.69-0.04)	3.50(1.61-5.89)	1.40(-0.91-3.78)
New York					
Incidence	54(5-134)	21(10-32)	45(0-130)	67585(34406-100516)	31940(-20659-71835)
Valuation	1.78(0.17-4.41)	0.59(0.28-0.92)	0.01(-3.05-0.05)	4.45(2.05-7.50)	1.80(-1.16-4.83)
North Carolina					
Incidence	65(6-161)	25(12-39)	51(0-147)	82006(41840-121768)	38873(-25480-86701)
Valuation	2.13(0.20-5.27)	0.70(0.34-1.09)	0.02(-3.44-0.05)	5.41(2.49-9.09)	2.19(-1.43-5.89)
Ohio					
Incidence	90(8-224)	35(17-55)	54(0-156)	90748(46284-134784)	43422(-28399-96985)
Valuation	2.96(0.28-7.31)	1.00(0.48-1.55)	0.02(-3.66-0.06)	5.98(2.75-10.06)	2.45(-1.60-6.58)
Pennsylvania					
Incidence	84(8-207)	30(14-47)	71(0-205)	87073(44373-129405)	39080(-25430-87561)
Valuation	2.75(0.26-6.79)	0.86(0.41-1.33)	0.03(-4.79-0.08)	5.74(2.64-9.65)	2.20(-1.43-5.92)
Rhode Island					
Incidence	5(0-13)	2(0-3)	3(0-10)	5962(3036-8867)	2626(-1700-5903)
Valuation	0.18(0.01-0.45)	0.05(0.02-0.08)	0.00(-2.41-0.00)	0.39(0.18-0.66)	0.14(-0.09-0.39)
South Carolina					
Incidence	25(2-61)	10(4-15)	17(0-51)	32099(16358-47702)	15047(-9797-33703)
Valuation	0.81(0.07-2.01)	0.28(0.13-0.44)	0.00(-1.19-0.02)	2.11(0.97-3.56)	0.84(-0.55-2.28)
Tennessee					
Incidence	160(15-394)	64(31-99)	25(0-72)	57589(29394-85487)	26750(-17574-59579)
Valuation	5.21(0.50-12.84)	1.79(0.87-2.78)	0.01(-1.70-0.02)	3.79(1.75-6.38)	1.50(-0.99-4.05)
Vermont					
Incidence	1(0-4)	0(0-1)	0(0-2)	2253(1145-3354)	972(-623-2197)
Valuation	0.05(0.00-0.14)	0.02(0.01-0.03)	0.00(-6.33-0.00)	0.14(0.06-0.25)	0.05(-0.03-0.14)
Virginia					
Incidence	49(4-121)	18(9-29)	39(0-114)	65302(33300-97003)	29410(-19217-65725)
Valuation	1.61(0.15-3.98)	0.53(0.25-0.82)	0.01(-2.67-0.04)	4.30(1.98-7.24)	1.65(-1.08-4.46)
West Virginia					
Incidence	27(2-66)	11(5-17)	10(0-31)	17997(9191-26706)	7555(-4979-16792)
Valuation	0.88(0.08-2.16)	0.31(0.15-0.48)	0.00(-7.33-0.01)	1.18(0.54-1.99)	0.42(-0.28-1.14)
Wisconsin					
Incidence	20(1-50)	9(4-14)	11(0-33)	25196(12820-37487)	11969(-7717-26970)
Valuation	0.66(0.06-1.65)	0.25(0.12-0.39)	0.00(-7.75-0.01)	1.66(0.76-2.79)	0.67(-0.43-1.81)

Supplemental Material, Table S3. Choice of valuation methods used in BenMAP-CE. All valuation methods chosen are methods used by the U.S. EPA for regulatory impact analyses. For detailed explanation of these methods, see U.S. EPA (2018).

Health Endpoint	Valuation Method
Mortality	VSL, based on 26 value-of-life studies / Weibull/0-99
Hospital Admissions – Respiratory	COI: Medical costs + wage losses
ER Visits, respiratory	COI: Smith et al. (1997) Triangular distribution COI: Stanford et al. (1999) Normal distribution
MRAD	WTP: 1 day, CV studies Triangular distribution
Asthma Exacerbation	WTP: bad asthma day, Rowe and Chestnut (1986) Uniform distribution

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