Lawrence Livermore National Laboratory

INQUIRY DATE: 5/21/2008 12:30 pm PST
REQUESSTED RESPONSE DATE/TIME: 5/22/2008 8:00 am PST

Tasking:
What would be the potential impact of an accidental release of foot-and-mouth disease (FMD) from each of the proposed locations for the National Bio and Agro-Defense Facility (NBAF).

Suspense timeline:
Provide initial response by 8am tomorrow and expect follow on inquiries.

Participants:
LLNL FAD analysis team

Content of the response:

General comments and model assumptions……2

Summary and comparison of impact for all six locations……...3

Detailed Results by Proposed Site Location:
Georgia (Clarke County)……7
Georgia (Oglethorpe County)……7
Kansas (Riley County)……8
Mississippi (Madison County)……...8
New York (Suffolk County, NY)……9
New York (New London, CT)……...9
North Carolina (Granville County)……10
Texas (Bexar County) …… ……10
Texas (Medina County)…… ……11

Scenarios Evaluated:
Nine scenarios were evaluated to provide an initial evaluation the potential impact of an accidental foot and mouth (FMD) virus release from each of the six potential NBAF sites. In some cases, more than one county was evaluated per location if the site was in close proximity to a county boarder. The scenarios evaluated included outbreaks beginning in Georgia (Clarke and Oglethorpe Counties), Kansas (Riley County), Mississippi (Madison County), Plum Island, New York (Suffolk, NY and New London, CT) North Carolina (Granville County), and Texas (Bexar and Medina Counties).

Modeling assumptions:
For the purposes of this work, no assumptions were made regarding the mechanism or quantity of foot-and-mouth disease virus (FMDV) involved in the accidental release modeled at each NBAF site. The virus could have escaped via an accidental aerosol release, a contaminated fomite (indirect contact), or release of an infected animal (direct contact). We assume that the FMDV escape was sufficient to infect one animal, on a randomly selected premise in the county (or neighboring county) in which the proposed NBAF site is located.

Once the index case is detected, a set of baseline response measures, consistent with the current ’07 FMD modeling assumptions, were implemented. All controls were fully implemented without resources constrained. The baseline control measures are as follows:

- Contact reductions for direct and indirect (high risk and low risk) contacts in designated control zones (quarantine zone – QZ, infected zone - IZ and buffer surveillance zone - BSZ)
- Stoppage of all interstate movement of livestock out of the affected states
- Closing of all sales yards within designated control zones
- Trace-back and trace-forward of direct contacts for one generation
- Slaughter of confirmed infected herds after a species-dependent delay
- No preemptive depopulation of non-infected herds
- No vaccination

For additional details on the specific control measures and their efficacy please see the LLNL ’07 FMD Systems Studies Analysis.

Suggestions for additional analysis:
This report summarizes result from only **one** potential introduction scenario for each site; additional work should be evaluated to provide a more comprehensive understanding of the potential impact of an accidental release from each site. Specifically, additional work should be completed to evaluate;

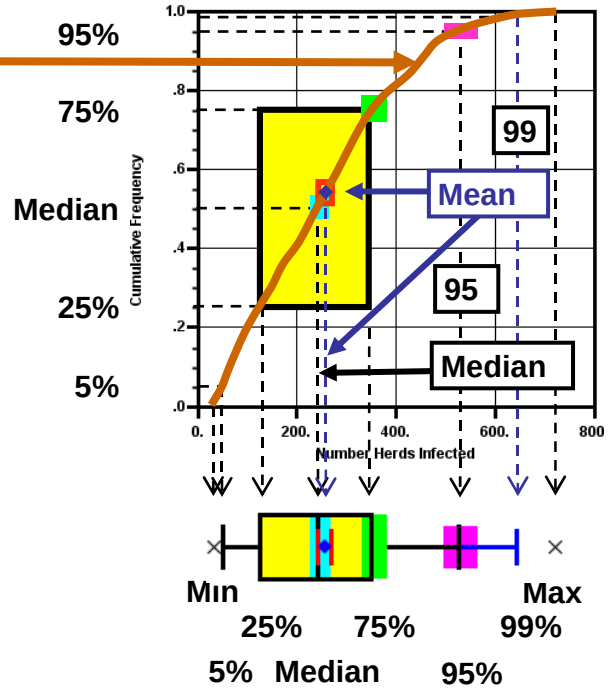
1. The introduction occurring over a wider geographic distribution.
2. The introduction occurring on more than one premises
3. An assessment of an aerosol release should be conducted to assess the potential for aerosol dispersion from each of the six locations for a variety of plausible levels of FMDV release. A full understanding of the impact of an accidental aerosol release may be hampered by a lack of readily available information on the exact location of livestock premises at risk in those areas.

Summary and comparison of impact for all six locations:

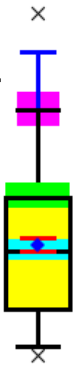
Summary results (duration, herds, animals, direct and indirect costs) for each of the nine scenarios are compared using enhanced box-whisker plots. The key for understanding the enhanced box-wisker plots is shown below.

Mapping of CDF to box-whisker

Cumulative distribution function (CDF) representing how often an outbreak remains less than a given size



Enhanced Box-whisker plot with additional 99% whisker and uncertain ranges



95% Confidence intervals for

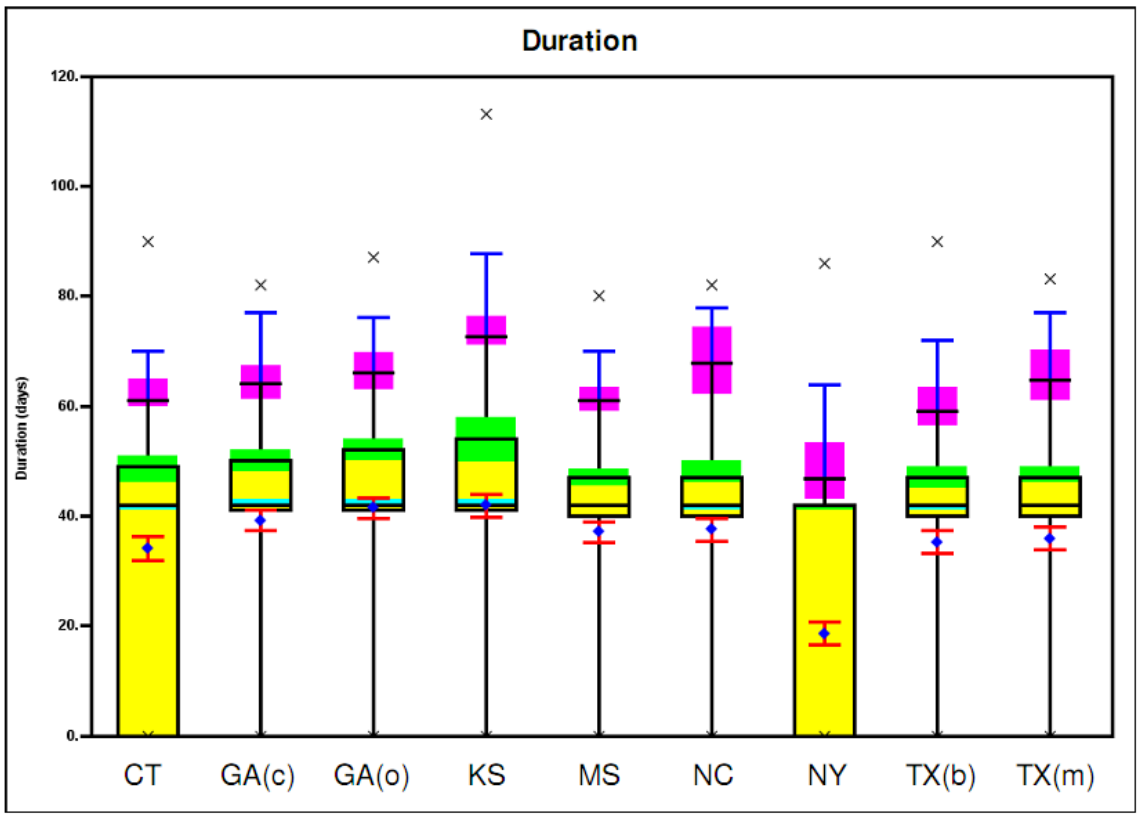
Median

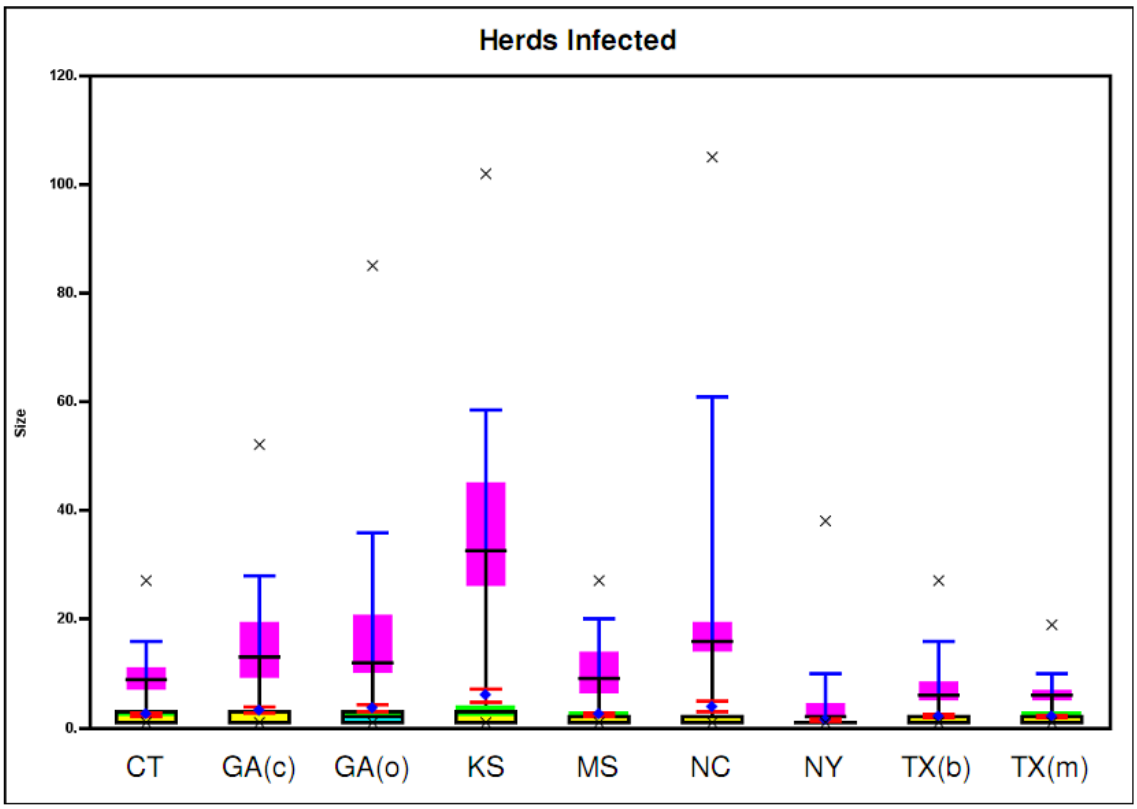
75%

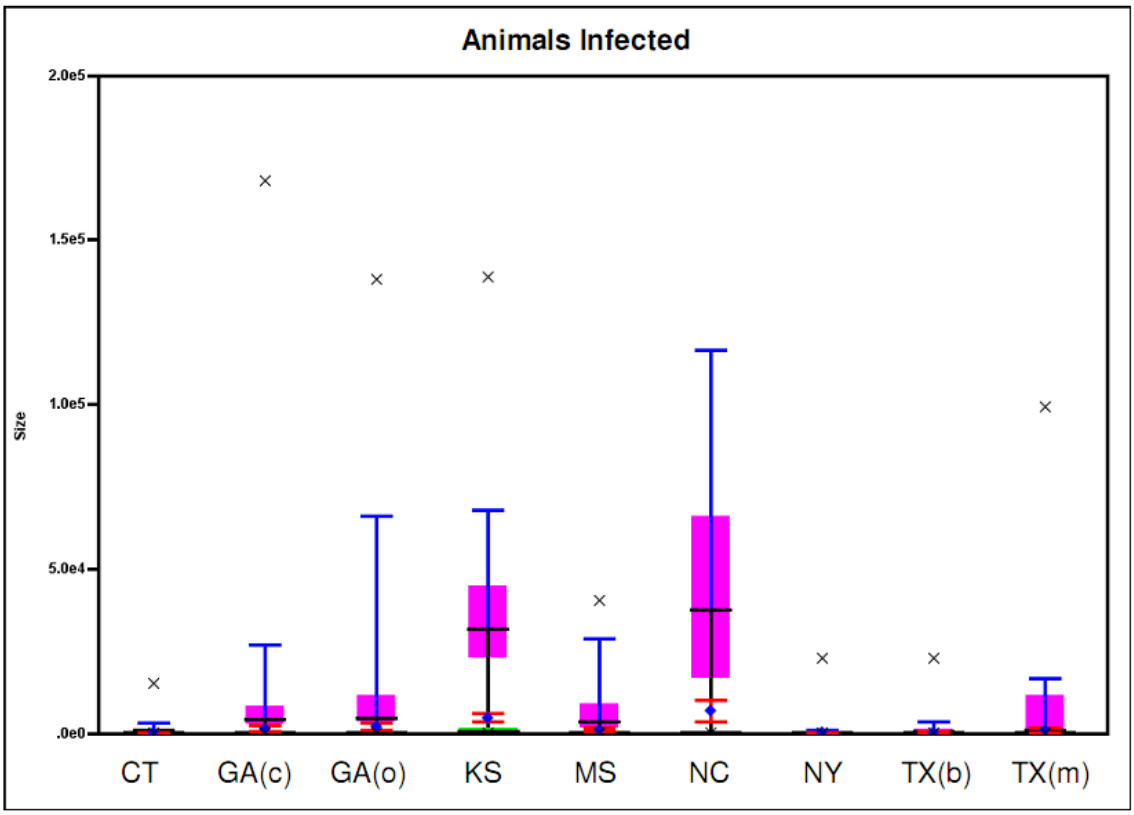
95%

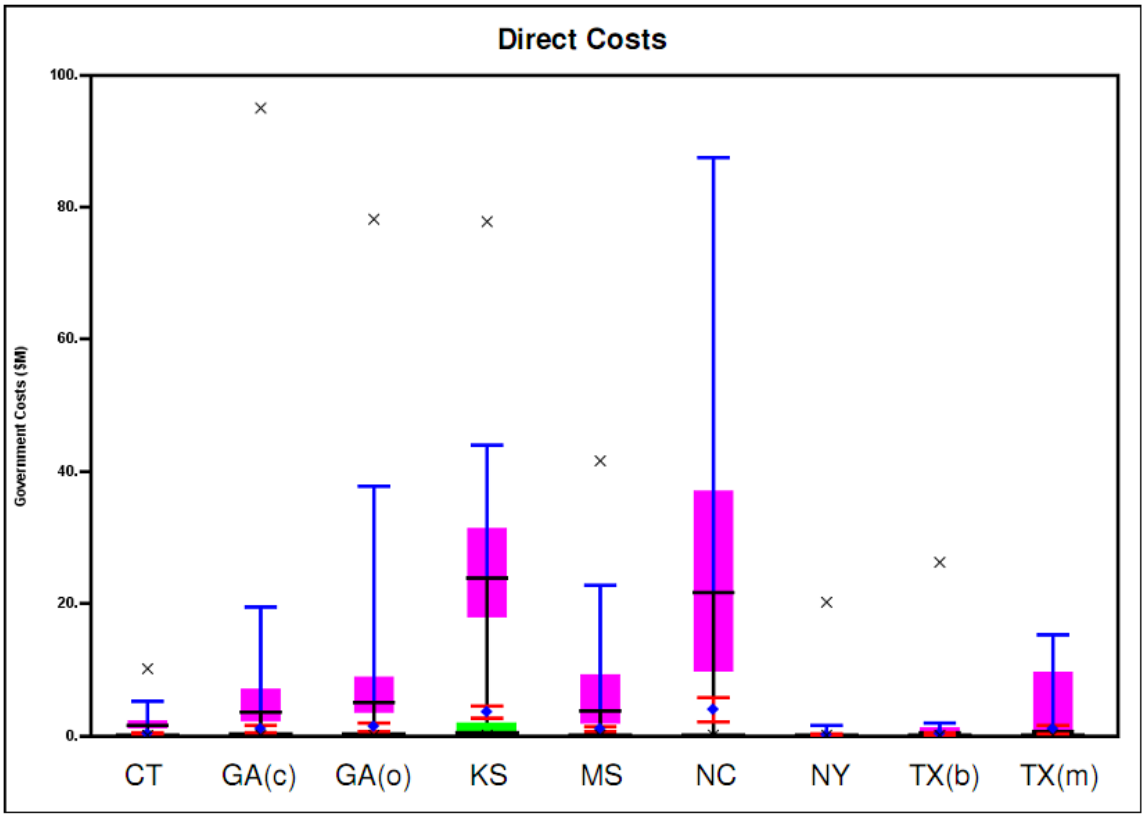
are defined by $1.96\ (N\ p\ (1-p)\ )^{½}$, where N is the number of Monte Carlo runs and p is the percentile fraction

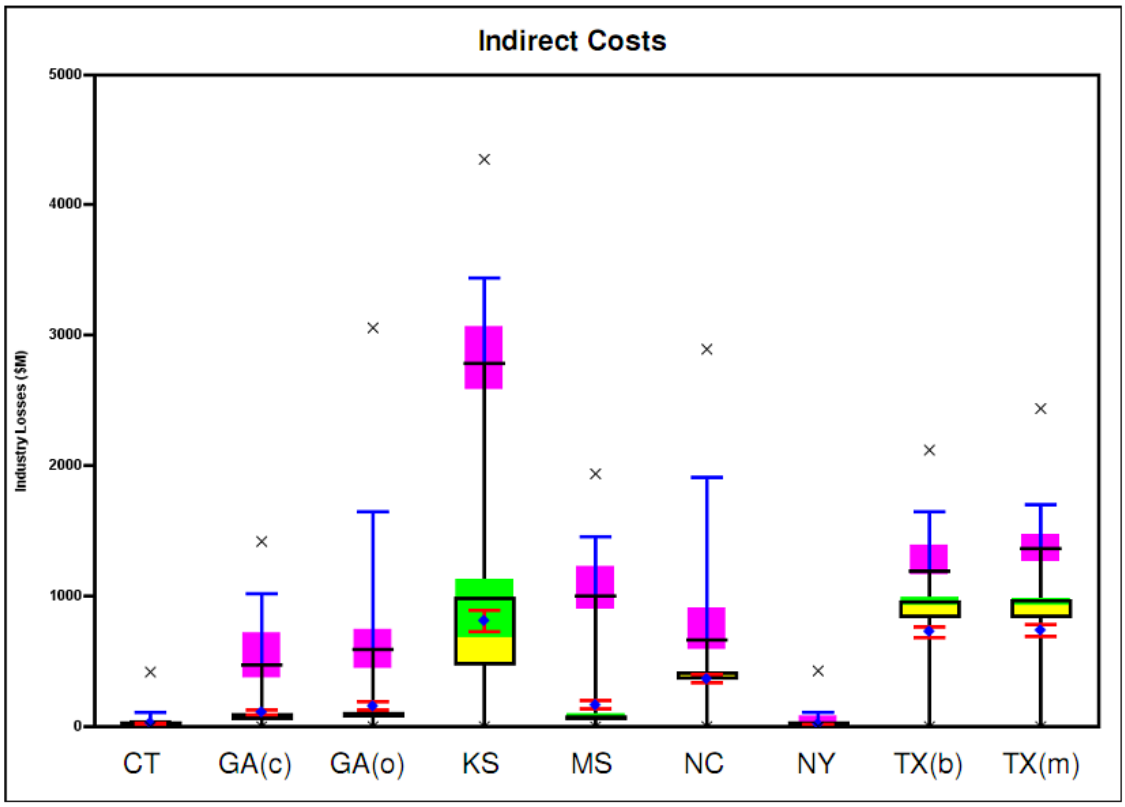
| | bars represent confidence interval for the mean ♦


Duration
Duration (days)
120.
100.
80.
60.
40.
20.
0.
CT
GA(c)
GA(o)
KS
MS
NC
NY
TX(b)
TX(m)


Herds Infected
Size
120.
100.
80.
60.
40.
20.
0.
CT
GA(c)
GA(o)
KS
MS
NC
NY
TX(b)
TX(m)


Animals Infected
Size
2.0e5
1.5e5
1.0e5
5.0e4
.0e0
CT
GA(c)
GA(o)
KS
MS
NC
NY
TX(b)
TX(m)


Direct Costs
Government Costs ($M)
100.
80.
60.
40.
20.
0.
CT
GA(c)
GA(o)
KS
MS
NC
NY
TX(b)
TX(m)


Indirect Costs
Industry Losses ($M)
5000
4000
3000
2000
1000
0
CT
GA(c)
GA(o)
KS
MS
NC
NY
TX(b)
TX(m)

Results: Summary Statistics (95% Confidence Intervals) for Basic NBAF Associated FMD Outbreak Scenarios

Summary results by scenario (duration, herds, animals, direct and indirect costs) for each of the nine scenarios for the mean, 5th, 25th, 50th, 75th, 90th and 95th percentiles and the corresponding 95% confidence intervals are presented in the following tables.

Scenario 1: Clarke, GA

	Outbreak Duration (days)	Number of Premises Infected	Number of Animals Infected	Direct Costs ($M)	Indirect Costs ($M)
Mean	62 [59, 64]	3 [3, 4]	1327 [444, 2210]	1 [0.4907, 2]	109 [90, 127]
Percentiles					
5	5 [5, 6]	1 [1, 1]	6 [6, 9]	0.0034 [0.0034, 0.0064]	0 [0, 0]
25	58 [55, 61]	1 [1, 1]	31 [31, 31]	0.0323 [0.0323, 0.0323]	57 [57, 57]
50	69 [67, 71]	1 [1, 1]	31 [31, 68]	0.0323 [0.0323, 0.0709]	57 [57, 57]
75	79 [78, 81]	3 [3, 3]	237 [199, 334]	0.2864 [0.2059, 0.3483]	86 [77, 92]
90	88 [86, 91]	7 [5, 9]	1197 [1013, 2895]	1 [1, 2]	183 [142, 372]
95	94 [91, 98]	13 [9, 19]	4090 [2716, 8126]	4 [2, 7]	469 [369, 717]

Scenario 2: Oglethorpe, GA

	Outbreak Duration (days)	Number of Premises Infected	Number of Animals Infected	Direct Costs ($M)	Indirect Costs ($M)
Mean	65 [63, 68]	4 [3, 4]	1993 [902, 3085]	1 [0.724, 2]	153 [122, 185]
Percentiles					
5	6 [5, 7]	1 [1, 1]	9 [9, 10]	0.0094 [0.0094, 0.0098]	0 [0, 0]
25	61 [58, 63]	1 [1, 1]	45 [45, 45]	0.0469 [0.0469, 0.0469]	81 [81, 81]
50	71 [69, 74]	2 [1, 2]	78 [47, 95]	0.0813 [0.0491, 0.099]	81 [81, 81]
75	81	3	205	0.2167	96

	[79, 82]	[2, 3]	[174, 277]	[0.1811, 0.2886]	[93, 100]
90	89 [86, 92]	8 [6, 10]	1416 [725, 3480]	2 [0.8343, 3]	208 [167, 447]
95	96 [92, 102]	12 [10, 21]	4494 [3463, 11592]	5 [3, 9]	584 [445, 739]

Scenario 3: Riley, KS

	Outbreak Duration (days)	Number of Premises Infected	Number of Animals Infected	Direct Costs ($M)	Indirect Costs ($M)
Mean	65 [62, 68]	6 [5, 7]	4717 [3369, 6064]	4 [3, 4]	807 [726, 888]
Percentiles					
5	6 [6, 7]	1 [1, 1]	8 [8, 8]	0.0083 [0.0058, 0.0083]	0 [0, 0]
25	59 [55, 61]	1 [1, 1]	82 [82, 82]	0.0854 [0.0854, 0.0854]	477 [477, 477]
50	71 [67, 72]	1 [1, 1]	123 [82, 123]	0.1282 [0.0854, 0.1282]	477 [477, 477]
75	82 [80, 86]	3 [2, 4]	574 [338, 1591]	0.5147 [0.2854, 2]	977 [679, 1120]
90	95 [92, 99]	20 [13, 26]	14993 [8431, 22827]	10 [8, 18]	2221 [1882, 2586]
95	103 [99, 108]	33 [26, 45]	31556 [22799, 44692]	24 [18, 31]	2780 [2585, 3063]

Scenario 4: Madison, MS

	Outbreak Duration (days)	Number of Premises Infected	Number of Animals Infected	Direct Costs ($M)	Indirect Costs ($M)
Mean	61 [58, 63]	2 [2, 3]	1069 [607, 1532]	1 [0.5829, 1]	163 [131, 194]
Percentiles					
5	6 [5, 6]	1 [1, 1]	9 [9, 9]	0.0094 [0.0073, 0.0094]	0 [0, 0]
25	59 [55, 60]	1 [1, 1]	51 [51, 51]	0.0531 [0.0531, 0.0531]	55 [55, 55]
50	68	1	67	0.0698	55

	[66, 70]	[1, 1]	[67, 67]	[0.0698, 0.0698]	[55, 55]
75	79 [77, 81]	2 [2, 3]	161 [109, 217]	0.1657 [0.112, 0.2261]	69 [63, 94]
90	86 [85, 89]	5 [4, 7]	970 [663, 1510]	1 [0.6908, 2]	534 [203, 898]
95	93 [89, 96]	9 [6, 14]	3440 [1498, 8817]	4 [2, 9]	996 [898, 1228]

Scenario 5: Suffolk, NY

	Outbreak Duration (days)	**Number of Premises Infected**	**Number of Animals Infected**	**Direct Costs ($M)**	**Indirect Costs ($M)**
Mean	33 [30, 36]	1.4 [1.2, 1.7]	123 [1.61, 244]	0.12 [0.0073, 0.23]	14 [11, 17]
Percentiles					
5	3 [2, 4]	1 [1, 1]	4 [4, 4]	0.0032 [.0032, .0032]	0 [0, 0]
25	6 [6, 7]	1 [1, 1]	5 [5, 5]	0.0032 [.0032, .0032]	0 [0, 0]
50	10 [9, 12]	1 [1, 1]	5 [5, 6]	0.0042 [.0034, .0042]	0 [0, 0]
75	63 [61, 66]	1 [1, 1]	8 [8, 8]	0.0054 [.0054, .0054]	24 [24, 24]
90	74 [72, 77]	1 [1, 2]	49 [40, 128]	0.051 [0.027, 0.074]	24 [24, 24]
95	82 [77, 86]	2 [2, 4.4]	135 [127, 314]	0.091 [0.074, 0.29]	27 [24, 74]

Scenario 6: New London County, CT

	Outbreak Duration (days)	**Number of Premises Infected**	**Number of Animals Infected**	**Direct Costs ($M)**	**Indirect Costs ($M)**
Mean	54.3 [51.2, 57.4]	2.5 [2.2, 2.8]	242.5 [156, 330]	0.35 [0.24, 0.45]	19.4 [17.3, 22.6]
Percentiles					
5	4 [3, 5]	1 [1, 1]	5 [5, 5]	0.0034 [.0032, .0034]	0 [0, 0]
25	10.8 [8, 52]	1 [1, 1]	8 [8, 9.5]	0.0083 [.0083, .0083]	0 [0, 0.86]
50	64 [62, 67]	1 [1, 1]	17 [16, 20]	0.018 [0.017, 0.018]	24.2 [24.2, 24.2]
75	76 [73, 77]	3 [2, 3]	178.3 [158, 240]	0.17 [0.16, 0.3]	25.1 [24.4, 25.2]
90	86.7 [83, 90]	5 [4, 7]	547.4 [456, 681]	0.84 [0.65, 1.0]	26.0 [25.5, 29.2]
95	92.8	8.9	866.2	1.5	32.2

	[90, 105.4]	[7, 11]	[675, 1428]	[1.0, 2.2]	[29.2, 37.1]

Scenario 7: Granville, NC

	Outbreak Duration (days)	Number of Premises Infected	Number of Animals Infected	Direct Costs ($M)	Indirect Costs ($M)
Mean	59, [56, 62]	4 [3, 5]	6622 [3330, 9914]	4 [2, 6]	364 [332, 395]
Percentiles					
5	5 [4, 6]	1 [1, 1]	7 [7, 8]	0.0041 [.0039, .0051]	0 [0, 0]
25	55 [45, 59]	1 [1, 1]	35 [9, 35]	0.0345 [0.0094, 0.0365]	372 [12, 372]
50	67 [66, 69]	1 [1, 1]	35 [35, 44]	0.0365 [0.0365, 0.0376]	372 [372, 372]
75	77 [75, 79]	2 [2, 2]	109 [81, 185]	0.1068 [0.0844, 0.1927]	407 [389, 414]
90	86 [84, 91]	8 [6, 14]	2589 [686, 17330]	3 [0.7598, 10]	520 [490, 592]
95	94 [91, 99]	16 [14, 19]	37335 [16456, 65878]	22 [10, 37]	660 [590, 902]

Scenario 8: Bexar, TX

	Outbreak Duration (days)	Number of Premises Infected	Number of Animals Infected	Direct Costs ($M)	Indirect Costs ($M)
Mean	57 [55, 60]	2 [2, 2]	247 [99, 395]	0.253 [0.0863, 0.4198]	720 [678, 762]
Percentiles					
5	6 [5, 6]	1 [1, 1]	8 [8, 8]	0.0083 [0.006, 0.0083]	0 [0, 0]
25	54 [20, 57]	1 [1, 1]	30 [24, 30]	0.0313 [0.025, 0.0313]	843 [0, 843]
50	64 [62, 66]	1 [1, 1]	30 [30, 36]	0.0313 [0.0313, 0.0375]	843 [843, 843]
75	76 [74, 78]	2 [2, 2]	73 [62, 97]	0.0714 [0.0636, 0.0962]	948 [923, 989]

90	85 [83, 89]	4 [3, 5]	196 [158, 280]	0.1915 [0.1405, 0.2898]	1084 [1064, 1164]
95	94 [89, 104]	6 [5, 8]	571 [278, 1123]	0.541 [0.2885, 1]	1184 [1164, 1385]

Scenario 9: Medina, TX

	Outbreak Duration (days)	Number of Premises Infected	Number of Animals Infected	Direct Costs ($M)	Indirect Costs ($M)
Mean	58 [55, 61]	2 [2, 2]	917 [345, 1490]	0.9246 [0.3324, 2]	736 [692, 780]
Percentiles					
5	5 [5, 6]	1 [1, 1]	8 [6, 8]	0.0083 [0.0063, 0.0083]	0 [0, 0]
25	53 [10, 56]	1 [1, 1]	40 [40, 40]	0.0417 [0.0417, 0.0417]	843 [0, 843]
50	67 [65, 68]	1 [1, 1]	40 [40, 48]	0.0417 [0.0417, 0.05]	843 [843, 843]
75	77 [74, 81]	2 [2, 3]	98 [83, 119]	0.0951 [0.0865, 0.1206]	963 [923, 983]
90	90 [86, 95]	5 [4, 5]	278 [196, 503]	0.2748 [0.2042, 0.4084]	1164 [1104, 1267]
95	99 [95, 107]	6 [5, 7]	777 [501, 11639]	0.5662 [0.4058, 10]	1365 [1265, 1470]

Note: A previous BKC Rapid Tasker report (August 6, 2007) prepared for DHS detailed the livestock population densities at risk in proximity to five of the six potential NBAF sites (based on the 2002 NASS data).