

COMMONWEALTH OF KENTUCKY  
BEFORE THE PUBLIC SERVICE COMMISSION

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PUBLIC SERVICE  
COMMISSION

In the Matter of:

APPLICATION OF KENTUCKY UTILITIES )  
COMPANY FOR CERTIFICATES OF )  
PUBLIC CONVENIENCE AND NECESSITY ) CASE NO. 2011-00161  
AND APPROVAL OF ITS 2011 COMPLIANCE )  
PLAN FOR RECOVERY BY )  
ENVIRONMENTAL SURCHARGE )

In the Matter of:

APPLICATION OF LOUISVILLE GAS AND )  
ELECTRIC COMPANY FOR CERTIFICATES )  
OF PUBLIC CONVENIENCE AND NECESSITY ) CASE NO. 2011-00162  
AND APPROVAL OF ITS 2011 )  
COMPLIANCE PLAN FOR RECOVERY BY )  
ENVIRONMENTAL SURCHARGE )

**RESPONSES AND OBJECTIONS OF NATURAL RESOURCES DEFENSE COUNCIL  
AND SIERRA CLUB TO DATA REQUESTS OF KENTUCKY UTILITIES COMPANY  
AND LOUISVILLE GAS AND ELECTRIC COMPANY**

Intervenors Natural Resources Defense Council and Sierra Club (collectively, “Intervenors”) hereby submit their responses and objections to the Data Requests of Kentucky Utilities Company and Louisville Gas & Electric Company (collectively, “Companies”):

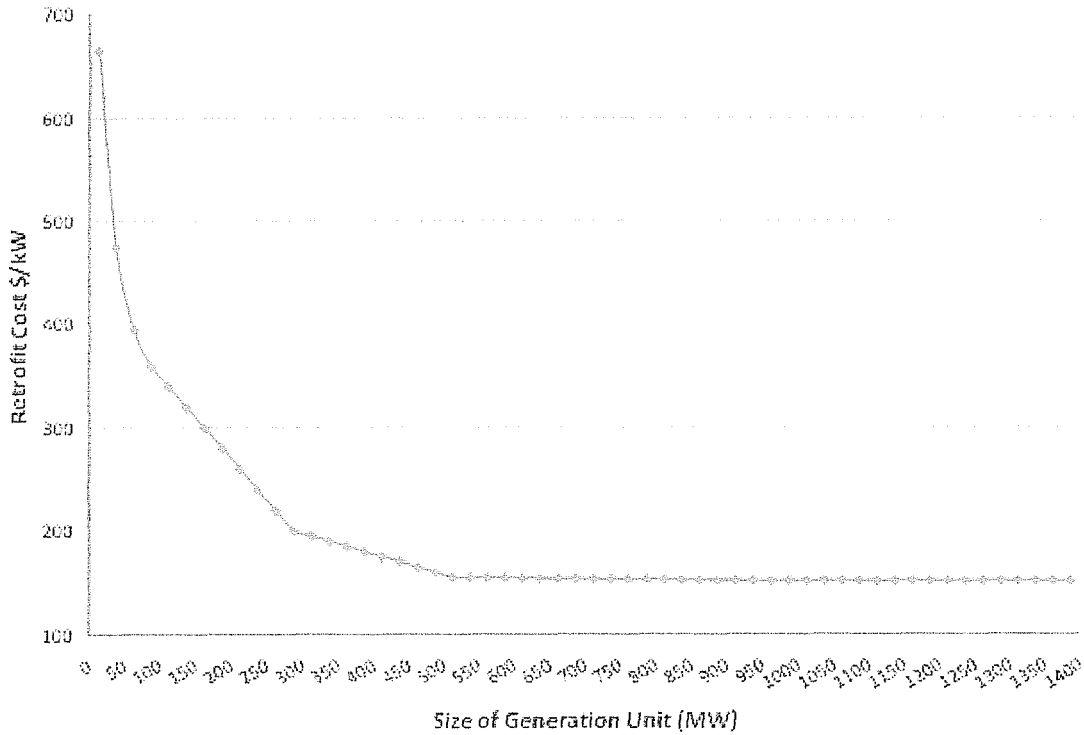
1. Please refer to Dr. Fisher’s direct testimony at 16, wherein he states, “Using cost assumptions from a [sic] North American Electric Reliability Council (NERC), I estimate the cost of a cooling tower for Mill Creek unit 1 at around \$70 million.”
  - a. Please describe the type of cooling tower to which Dr. Fisher refers.

**RESPONSE: Jeremy Fisher**

“Cooling towers” here refers to conversion to a closed cycle cooling system using evaporative cooling towers. The source document from which these costs are derived is non-

specific to the type of cell or tower, or design specifications. Rather, the source supplies a curve with economies of scale (see figure below). The cost for Mill Creek 1 was obtained by multiplying the “retrofit cost” at 356 MW by the nameplate capacity of Mill Creek 1, and rounding.

Figure II-3: Base Case Retrofit Cost Curve for Section 316(b)(\$/kW)



b. Including the specific NERC reference document referred to in the direct testimony, please provide any and all documents or other information upon which Dr. Fisher based his cost projection.

**RESPONSE: Jeremy Fisher**

Dr. Fisher relied on the NERC report, which is being produced with these responses.

2. Please refer to Dr. Fisher's direct testimony at 42, wherein he states, "[T]he Commission should deny CPCNs and rate treatment for any upgrades to the Companies' coal units at this time."
  - a. How does Dr. Fisher propose LG&E and KU comply with the environmental regulations at issue in this proceeding while meeting their service obligations to customers if the Commission followed Dr. Fisher's recommendation?
  - b. Has Dr. Fisher attempted to calculate the costs of his recommendation?
  - c. For KU and LG&E for each year of the study period, what would be the rate impact of following Dr. Fisher's recommendation? Please provide all calculations and supporting work-papers in electronic format (the latter in Microsoft Excel format with formulas intact and unlocked).

**RESPONSE: Jeremy Fisher**

- a. Intervenors object to this request to the extent that it suggests that Intervenors bear the burden of identifying resource proposals that satisfy the requirements for obtaining a CPCN. In fact, it is the Companies as the applicants who bear the burden of setting forth the facts necessary to demonstrate entitlement to a CPCN. 807 KAR 5:001(9)(2)(a). Subject to and without waiving the foregoing objection, Intervenors state that Dr. Fisher's testimony does not specifically address how the Companies should meet their service obligations while complying with environmental regulations. Such matters are appropriately addressed within the context of an integrated resource plan (IRP) and with sufficient Company information and resources, unavailable at this time to intervenors.
- b. As described more fully in Intervenors' response to Commission Staff Request 3.a, Dr. Fisher's recommendation in direct testimony is that "the Commission deny CPCN and rate treatment for retrofitting the Brown 1 & 2 units... [and] deny CPCN and rate treatment for retrofitting Mill Creek 1 & 2 units... [and] assess, in greater detail and with a greater range of uncertainty, the risks posed in retrofitting the Mill Creek 1 & 2 units." Modeling indicates that the CPCN for Brown 1 & 2 and Mill Creek 1 & 2 should be denied because such a course of action ultimately saves ratepayer money relative to the plan put forth by the Companies. The recommendation of an assessment of the

compliance risks posed to Mill Creek 1 & 2 is an appropriate mechanism to ensure that the Companies' actions do not result in unnecessary costs to ratepayers.

It should be noted that additional modeling and assessment on the part of the Companies comprises a very small fraction of the costs and expenditures contemplated in this proceeding.

- c. Dr. Fisher has not recommended a specific plan, and thus there is no "rate impact of following" his plan. The formulation of a plan, and resulting rate and bill impacts, are appropriately addressed within the context of an IRP and with sufficient Company information and resources, unavailable at this time to interveners. It is expected that the denial of CPCN for Brown 1 & 2 and Mill Creek 1 & 2 will save ratepayer money relative to the proposal put forth by the Companies. Further, regardless of if the ultimate decision results in capital expenses for retrofits or new generation, the Companies have mechanisms at their disposal, not contemplated in this filing, to reduce bill impacts and requirements, such as market purchases, PPAs, and the procurement of demand-side management measures.

3. Dr. Fisher states at page 37 of his direct testimony that he believes the Companies have used too high a cost for emergency energy in their modeling.

- a. What is the value Dr. Fisher would place on unserved energy?
- b. Please provide all reasoning and documents supporting Dr. Fisher's proposed value.

**RESPONSE: Jeremy Fisher**

- a. The question is based on a false premise: the capacity gaps that the model fills with "emergency energy" does not necessarily represent "energy not served." The same gap could be filled with short term market purchases from connected utilities and RTOs,

demand response resources, and through emergency measures that do not include forced outages. In most RTOs, including PJM and MISO (both of which are connected to LG&E/KU), emergency measures dictate a variety of responses, from grid adjustments to calling interruptible load resources, that proceed last resort rolling blackouts. The Companies cost of “energy not served” only represents the most extreme cost as perceived by customers.

b. See response to request 3a.

4. At page 40 of Dr. Fisher’s direct testimony, he suggests that the order of retirement the Companies used to evaluate whether to retrofit with environmental controls or to retire their coal units may have affected their proposed retrofit-versus-retire decisions for certain units.

a. Which order(s) of retirements would Dr. Fisher propose in the alternative?

b. What impact, if any, would Dr. Fisher’s proposed retirement ordering(s) have on the retrofit-versus-retire decisions the Companies have proposed? Please provide all supporting work-papers and other related documents in paper and electronic formats.

**RESPONSE: Jeremy Fisher, Rachel Wilson**

a. Intervenors object to this request to the extent that it suggests that Intervenors bear the burden of identifying resource proposals that satisfy the requirements for obtaining a CPCN. In fact, it is the Companies as the applicants who bear the burden of setting forth the facts necessary to demonstrate entitlement to a CPCN. 807 KAR 5:001(9)(2)(a). Subject to and without waiving the foregoing objection, Intervenors state as follows. Testing multiple “order(s) of retirements” is one mechanism of arriving at the optimal retire/retrofit plan, but it is the Companies’ responsibility to show that their plan results in the lowest cost and lowest risk. Based on both our testimony and the late-breaking Supplemental Analyses provided by the Companies, the suite of retire/retrofit decisions proposed by LG&E/KU is not the optimal plan. It is incumbent on the Companies to

determine and apply a mechanism to find the optimal portfolio of retirement and retrofit decisions that results in the lowest risk and cost to customers, and establish definitively that the suite of retrofit and retirement decisions actually results in the lowest reasonable PVRR.

- b. To test the question of what type of impact retirement reordering could have on the retrofit/retire decision, we conducted a simple test. For each unit, we tested the NPVRR of retiring only that unit against a no-retirements case. This test simply replicates the decision that would be made with the first unit examined in the Company's analysis scheme. Because retiring any given unit makes all other units appear marginally more economic, the relative economic merit of any given unit shrinks dramatically if the unit is examined first. The following tables show the Companies' analysis (with a corrected formula for the landfill year as described in my direct testimony) and "one-off" results, where the NPVRR of retiring each unit individually is tested. All other inputs are held constant with Company assumptions.

In this analysis, if Cane Run 6 is examined first, the net benefit of retrofitting this unit shrinks from positive \$11 million to negative \$55 million, while the Brown 1 & 2 units shrink from a net benefit of \$230 million to \$137 million, less than the PVRR of an SCR at these units. The data for the "one-off" studies are supplied in the accompanying Excel workbook.<sup>1</sup>

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<sup>1</sup> For these studies, Ms. Wilson used the no-retirements Strategist modeling run, and created a series of runs where only one unit was retired per run. The resulting new unit and capital costs were output from Strategist and Dr. Fisher input these data into the Company's retire/retrofit analysis workbook. Formulae were altered to reflect that only one unit was retired per run, but all other assumptions were left intact.

The fact that simply changing the order in which units are examined could feasibly change the retire/retrofit decision suggests that the mechanism employed by the Company is flawed.

KU / LG&E Assumptions	
Original, Formula Corrected	
CPCN Results, Landfill Year Corrected	
Tyrone 3	-13
Green River 3	-80
<b>Brown 3</b>	<b>603</b>
Cane Run 4	-87
Cane Run 6	11
<b>Brown 1-2</b>	<b>230</b>
Cane Run 5	-57
<b>Ghent 3</b>	<b>921</b>
<b>Ghent 1</b>	<b>800</b>
Green River 4	-110
Mill Creek 4	859
Trimble County 1	996
Ghent 4	1,161
Mill Creek 3	756
Ghent 2	1,146
Mill Creek 1-2	1,022

KU / LG&E Assumptions	
One-Off Results	
Units Retired Individually	
Tyrone 3	-13
Green River 3	-104
<b>Brown 3</b>	<b>566</b>
Cane Run 4	-194
Cane Run 6	-55
<b>Brown 1-2</b>	<b>137</b>
Cane Run 5	-158
<b>Ghent 3</b>	<b>612</b>
<b>Ghent 1</b>	<b>541</b>
Green River 4	-155
Mill Creek 4	522
Trimble County 1	746
Ghent 4	806
Mill Creek 3	513
Ghent 2	800
Mill Creek 1-2	675

5. The Companies did not contemplate the transmission cost impacts of retiring units they did not recommend retiring. Has Dr. Fisher attempted to estimate what would be the transmission costs necessitated by the unit retirements his various modeling runs suggested, including retiring Brown Units 1 and 2?

- a. If so, please provide the estimate and all supporting work-papers and other related documents in paper and electronic formats.
- b. If not, please explain why Dr. Fisher recommended retiring the Brown units without taking into account such costs.

**RESPONSE: Jeremy Fisher**

It is not clear whether the Companies' factored in transmission costs even for units that were recommended for retirement. If such costs are anticipated by the Companies, Dr. Fisher recommends that these costs be incorporated into the Companies' retire/retrofit model as a cost or benefit. At this time, there is no indication that additional transmission costs would be "necessitated by the unit retirements" that the Companies have not already proposed.

- a. Not applicable.
- b. Intervenors object to this request to the extent that it mischaracterized Dr. Fisher's testimony. Dr. Fisher did not recommend retiring specific units. Instead, with regards to Brown Units 1 & 2, Dr. Fisher evaluated the Companies' retire/retrofit modeling, determined that more reasonable inputs should have been used in such modeling, and urged denial of the requested CPCNs because the available evidence suggests that retrofit of Brown Units 1 & 2 is not the least cost option. Subject to and without waiving the foregoing objection, see response, above.

6. Dr. Fisher states at page 13 of his direct testimony, "After accounting for expected retirements, the Companies anticipate retrofitting their remaining partially-controlled units (Brown 1-3, Ghent 1-4, Mill Creek 1-4, and Trimble County 1) with flue gas desulfurization (FGD) ...." Please explain where in the 2011 compliance filing the Companies state a plan to "retrofit" their remaining units at Brown, Ghent, Mill Creek and Trimble Co. 1 with FGD.

**RESPONSE: Jeremy Fisher**

This statement is in error, but does not substantively change Dr. Fisher's testimony nor recommendations. While MACT requirements may be partially met through the installation and permitted use of FGD, the Brown 1-3 units have already installed a new FGD system, and the Trimble County unit is already in possession of an FGD unit. Of the non-retiring units, the four units at Mill Creek are anticipated by the Companies to require new or retrofit FGD systems (Revlett at 6).



7. Please provide the forecast of natural gas prices utilized as an input to Strategist in Synapse's re-analysis.

**RESPONSE: Jeremy Fisher**

	AESC 2011 HH Price + Delivery Charge + Seasonal Adjustment (2010\$/MCF) - REVISED
2011	5.32
2012	5.77
2013	5.95
2014	6.14
2015	6.81
2016	6.96
2017	6.92
2018	6.93
2019	6.96
2020	7.05
2021	7.16
2022	7.25
2023	7.55
2024	7.77
2025	7.84
2026	7.96
2027	8.12
2028	8.29
2029	8.52
2030	8.43
2031	8.45
2032	8.61
2033	8.76
2034	8.79
2035	8.98
2036	9.12
2037	9.27
2038	9.43
2039	9.57
2040	9.73
2041	9.88

8. Please confirm that the gas price forecast was the only input to Strategist that was changed in developing the NPVRR values for Box 3 in Exhibit JIF-2. If other Strategist inputs changed, please provide a summary of the changes.

**RESPONSE: Wilson**

The gas price forecast is the only input to Strategist changed in developing Box 3 in Exhibit JIF-2 (subsequently replaced Exhibit JIF-S3).

9. Please see page 8 of Dr. Fisher's direct testimony. What is the basis for the phrase, "ranging in size from 493 to 907 MW," at the bottom of the page?

**RESPONSE: Jeremy Fisher**

This statement is in error, and is revised to read as follows. The error does not substantively change Dr. Fisher's testimony, nor his recommendation.

"The Companies assume that replacement generation is only available from three types of natural gas plants, a single-cycle turbine of 194 MW, and two combined cycle sized at 605 and 907 MW (summer capacity), respectively (see p50 of the 2011 Air Compliance Plan). These large-size combined cycle units are larger than many of the coal units under consideration, forcing the model to only evaluate unduly expensive alternatives that present potentially non-optimal solutions."

10. Please produce in machine readable or txt format the input and output files for all Strategist modeling that Synapse completed in conjunction with its re-analysis.

**RESPONSE: Jeremy Fisher**

Intervenors are producing these files with these responses.

11. To the extent not provided in response to DR 10 above, please produce any work paper, source document, and, in machine readable or txt format, input and output files, used in or developed as part of the modeling carried out in developing Synapse's re-analysis.

**RESPONSE: Jeremy Fisher**

Attached. The folder contains seven variants on the Companies' analysis spreadsheet comprising Boxes 2-8 in Exhibit JIF-S3, as well as the spreadsheet for Exhibit JIF-S3, and the gas price forecast. The public version of this file has redacted the Company's natural gas price forecast.

12. Please see Dr. Fisher's direct testimony at page 24, lines 3-6.

a. Which 13 counties in Kentucky are estimated to violate the 2008 ozone standard at 0.075 ppm? Provide all support and documents indicating the 13 counties are estimated to violate the 2008 ozone standard.

b. Based on the most recent set of 3-year-average ozone data, which counties in Kentucky violate the 2008 ozone standard?

c. Which of the facilities in this 2011 Compliance Plan are located in counties that exceed the 2008 standard?

d. If facilities are not located in those counties, will those facilities be subject to the installation of NOx controls?

**RESPONSE: Jeremy Fisher**

- a. There are 11 counties which are in violation of the 0.075 ppm 8-hr standard according to EPA data collected in 2006-2008. Christian, Daviess, Greenup, Hancock, Hardin, Henderson, Jefferson, Kenton, Oldham, Simpson, and Trigg Counties. Two additional counties, Boydd and McCracken Counties could be in violation, but are currently at the 2008 compliance limit of 0.075 ppm. This information is available to the public at <http://www.epa.gov/air/ozonepollution/pdfs/CountyPrimaryOzoneLevels0608.pdf>

- b. This information is not yet available in a quality assured form, and we have not conducted this analysis. However, raw criteria pollutant data is reported in a raw form to the EPA at <http://epa.gov/ttn/airs/airsags/detaildata/downloadagsdata.htm>
- c. We have not compiled this information for all units in the 2011 Compliance Plan. I will note, however, that Mill Creek is located in Jefferson County, which is one of the counties in violation of the 0.075 ppm 8-hr standard.<sup>2,3</sup>
- d. Potentially. If there is a new standard and certain counties become nonattainment counties, the Commonwealth and Louisville APCD will have to write a SIP that outlines how nonattainment areas will be brought into attainment. The Commonwealth has the authority to require controls on contributing sources under the Clean Air Act Section 110(a)(2)(A) which, generically, allows the state to adopt whatever controls are necessary to meet the requirements of the Clean Air Act. NO<sub>x</sub> is an ozone precursor, and as such, may be regulated to meet ozone standards.

13. Please see Dr. Fisher's direct testimony at page 25, lines 15-17. Based on the reference cited in footnote 17 on page 24, Fayette County's 3-year average ozone level was 0.072 ppm, which is not "so far out of compliance" if the revised standard in a future proposed rule was set at 0.070 ppm. What impact will the addition of the SCR at Brown 3 scheduled to be in service in 2012 have on the Fayette County ozone monitor averages?

**RESPONSE: Jeremy Fisher**

Intervenors have not conducted such an analysis.

14. Please see Dr. Fisher's direct testimony at page 29, line 19. What is BACT (Best Available Control Technology) for CO<sub>2</sub>?

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<sup>2</sup> US EPA, 2010. Counties Violating the Primary Ground-Level Ozone Standard, 2006-2008. January 2010. <http://www.epa.gov/air/ozonepollution/pdfs/CountyPrimaryOzoneLevels0608.pdf>

<sup>3</sup> Kentucky Energy and Environment Cabinet. Commonwealth of Kentucky Boundary Recommendations: 8-Hour Ozone Standard, March 2009. [http://www.epa.gov/ozonedesignations/2008standards/rec/letters/04\\_KY\\_rec.pdf](http://www.epa.gov/ozonedesignations/2008standards/rec/letters/04_KY_rec.pdf)

**RESPONSE: Jeremy Fisher**

Best Available Control Technology (BACT) is an emission limit based on the best available control technology that is established on a case-by-case basis. EPA's existing regulations state that BACT only applies to emission units that are physically or operationally changed (40 CFR 52.21(j)(3)). A permitting authority must evaluate the amount of emissions reductions that each available emissions-reducing technology or technique would achieve, as well as the energy, environmental, economic and other costs associated with each technology or technique. Based on this assessment, the permitting authority must establish a numeric emissions limitation that reflects the maximum degree of reduction achievable for each pollutant subject to BACT through the application of the selected technology or technique (42 U.S.C. § 7479(3), App. E; 40 C.F.R. § 52.21(b)(12), App. H).

Given that BACT is an emission limit established on a case-by-case basis, it is impossible to state specifically cite "what is BACT." However, the EPA has produced guidance<sup>4</sup> discussing the control technologies that ought to be considered for GHG BACT. EPA notes that BACT might include efficiency improvements to the physical plant to effectively reduce the emissions rate, fuel switching (to higher heat content fuels or lower emissions fuels), or carbon capture and sequestration.

15. Please see Dr. Fisher's direct testimony at page 31, line 27.

a. If the Companies were to retain only Trimble Co. 1, Ghent 4, and Ghent 2 as suggested in Dr. Fisher's version of the model, what would be the cost imposed on the customers to replace the other generating units?

i. What would the expected rate impacts be in that case for LG&E and KU for each year of the study period?

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<sup>4</sup> U.S. Environmental Protection Agency, PSD and Title V Permitting Guidance for Greenhouse Gases (March 2011), available at <http://www.epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf>

- ii. Does Dr. Fisher recommend that the Companies also retire Trimble Co. 2?
- iii. If the replacement energy were derived from natural gas generation, is there adequate gas infrastructure in Kentucky?
- iv. If the replacement energy were derived from wind energy, how much capacity would be required to replace the capacity Dr. Fisher suggested would be uneconomic? Where would that wind energy originate? Is there adequate electric transmission infrastructure in place to support that alternative?
- v. What would be the impact on the bulk electric system reliability if the transmission infrastructure is not available at the time of the expected compliance deadlines?

**RESPONSE: Jeremy Fisher**

15a.i. - Intervenors did not carry out an analysis of the rate impacts of the retirement of any of the Companies electric generating units. Intervenors note, however, that with regards to Brown Units 1 & 2 and Mill Creek Units 1 & 2, the available evidence shows that CPCNs should be denied because retrofits of those units is not the least cost option. As such, denial of the CPCNs would likely save ratepayers money.

15a.ii. – Intervenors did not review retirement of Trimble Unit 2, or recommend any particular retirement.

15a.iii. – Intervenors have not evaluated the extent of natural gas infrastructure in Kentucky at this time. It is unclear that such generation would need to be derived exclusively from Kentucky. A proper approach would be to evaluate a mix of portfolios, with varying levels of wind, energy efficiency, natural gas, and other supply side and demand side resources.

15a.iv. – Intervenors have not evaluated replacement of specific LG&E or KU coal units with wind power. A proper approach would be to evaluate a mix of portfolios, with varying levels of wind, energy efficiency, natural gas, and other supply side and demand side resources.

15a.v. – Intervenors have not evaluated this issue at this time.

16. Please provide the factual basis and supporting documentation for the CO2 price forecast discussed on page 31, lines 1-4, of Dr. Fisher's direct testimony. Please do not provide in response another copy of the Synapse 2011 Carbon Dioxide Price Forecast that was included as Exhibit JIF-4 to Dr. Fisher's testimony; rather, please provide searchable electronic versions of all documents cited in that forecast, as well as any and all other documentation and factual support for the CO2 pricing forecast discussed in Dr. Fisher's testimony.

**RESPONSE: Jeremy Fisher, Counsel**

Intervenors object to this request because the documents requested are obtainable from publicly available sources that are equally accessible to the Companies. Subject to and without waiving the foregoing objection, Intervenors respond that the "factual basis" for the forecast is set forth in the Synapse 2011 Carbon Dioxide Price Forecast. All documents cited in the 2011 Carbon Dioxide Price Forecast are publicly accessible. Nonetheless, we have provided electronic versions of the non-hyperlinked documents in the attached folder.

17. To the extent not provided in response to DR 16 above, please provide the factual basis and any supporting documentation for Dr. Fisher's statement on page 31, line 3, of his direct testimony, which necessarily implies that CO2 pricing will apply to utilities in Kentucky beginning in 2018.

**RESPONSE: Jeremy Fisher**

Please see response to Staff Discovery Request 11.

18. Please provide all models, assumptions, and data (in machine readable format) related to the preparation of the AESC natural gas price forecast discussed on page 21 of Dr. Fisher's direct testimony.

**RESPONSE: Jeremy Fisher, Counsel**

Intervenors object to this request as overly broad and burdensome. Subject to and without waiving the foregoing objection, Intervenors state that this information is not in the possession of the Intervenors as they were not involved in the preparation of the AESC natural gas price

forecast. In addition, Dr. Fisher was neither an author nor a participant in the AESC study, and does not have access to this information. Ms. Wilson was an author on the report, but her role in the study was restricted to configuring and operating the Market Analytics (PROSYM) model

19. Please provide all data and documentation that supports Dr. Fisher's statement on page 19, line 25, of his direct testimony that "most analysts believe that the [natural gas] price will rise slowly over the next two decades."

**RESPONSE: Jeremy Fisher**

The term "slowly" here is meant in contrast to the Companies' rapidly climbing natural gas price. With the apparent exception of the proprietary reports used by the Companies, other analyses appear to generally place the long-term real price of natural gas at a stable price, or rising only slowly. Please refer to Figure 1 of Dr. Fischer's testimony, the documents cited in footnotes 8-15 of Dr. Fischer's testimony, and the data in Companies' Discovery Request 10.

20. Please refer to Figure 2 on page 22 of Dr. Fisher's direct testimony.

a. Please provide all supporting documentation and assumptions that cause the lower growth rate of natural gas prices beginning in 2016 as compared to 2011 through 2015.

b. Please provide all supporting documentation and assumptions that cause the higher growth rate of natural gas prices beginning in 2022 as compared to 2016 through 2021.

**RESPONSE: Jeremy Fisher**

The referenced growth rates are from the AESC study. Outside of what is contained in that Study, the supporting documentation and assumptions are not in the possession of the Interveners as they were not involved in the preparation of the AESC natural gas price forecast. In addition, Dr. Fisher was neither an author nor a participant in the AESC study, and does not have access to this information. Ms. Wilson was an author on the report, but her role in the study was restricted to configuring and operating the Market Analytics (PROSYM) model



21. Please provide a list of the “recent legislative proposals to mitigate carbon dioxide (CO<sub>2</sub>) emissions” described on page 29, lines 8-9, in Dr. Fisher’s direct testimony and the current status of those legislative proposals.

**RESPONSE: Jeremy Fisher**

Intervenors object to this request as information regarding legislative proposals to mitigate carbon dioxide emissions is publicly available and just as easily attainable by the Companies. Subject to and without waiving the foregoing objection, Intervenors state that legislative proposals, at a state, regional, and national scale, continue to be pursued, even though federal proposals were not successful in 2009 under the American Clean Energy and Security Act. The Synapse 2011 Carbon Dioxide Forecast describes state and regional initiatives designed to mitigate CO<sub>2</sub> emissions, including twenty one states that are “pursuing a wide variety of policies across the country” (p4).

22. Please provide all documentation that supports the use of CO<sub>2</sub> pricing as the basis for compliance with EPA’s CO<sub>2</sub> BACT regulations.

**RESPONSE: Jeremy Fisher**

Carbon dioxide pricing could not serve as the basis for compliance with EPA’s CO<sub>2</sub> BACT regulations. As noted above, BACT is an emission limit based on the best available control technology that is established on a case-by-case basis. Thus CO<sub>2</sub> pricing could never constitute BACT. However, the implementation of BACT controls, as discussed in Response to Companies’ Discovery Request 14, would impose a cost on the unit under consideration – either in capital expenditures, increases in fuel costs, operational and maintenance costs, or combinations thereof. Therefore, both legislative action implementing a greenhouse gas pricing

mechanism or regulatory action by the EPA (including promulgated rules) “could reasonably impose a cost on the emissions of CO<sub>2</sub>.”

Based on this question, it seems that the Companies conflated two separate arguments that I raised in my testimony. The Companies had projected zero compliance costs related to the fleets greenhouse gas emissions. Such an assumption is unreasonable.

23. Please provide all documentation for Dr. Fisher’s statement on page 36, lines 27-28, of his direct testimony, “In reality, the Companies are very well interconnected with their neighbors ....”

**RESPONSE: Jeremy Fisher**

According to the North American Reliability Corporation (NERC) control area bubble diagram (10/3/2011),<sup>5</sup> The KU/LG&E system at the juncture of two major RTOs (PJM and MISO) and is connected to the Ohio Valley Electric Corporation (OVEC), the Tennessee Valley Authority (TVA), the East Kentucky Power Cooperative (EKPC), and Electric Energy, Inc (EEI). Indeed, the ITO Semi-Annual Report from March 2011 – August 2011, filed by the Southwest Power Pool on September 30<sup>th</sup>, 2011,<sup>6</sup> lists numerous paths between the LGEE system and neighboring balancing authorities, including EEI, EKPC, MISO, PJM, and TVA.

24. Please provide all documentation supporting Dr. Fisher’s statements on page 37, lines 3-7, of his direct testimony regarding the Companies’ ability to purchase energy for “short periods” and for “fairly limited capacity requirements.” How does he define “short” and “limited”?

**RESPONSE: Jeremy Fisher**

Intervenors object to this request on the grounds that it mischaracterizes Dr. Fisher’s testimony.

Subject to and without waiving this objection, Intervenors state that Dr. Fisher’s testimony on

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<sup>5</sup> NERC, 2011. Regions and Balancing Authorities. [http://www.nerc.com/docs/oc/rs/BA\\_BubbleDiagram\\_2011-10-03.jpg](http://www.nerc.com/docs/oc/rs/BA_BubbleDiagram_2011-10-03.jpg)

<sup>6</sup> Available at: <http://www.spp.org/publications/ITO%20Semi-Annual%20Report%20March%202011-%20August%202011.pdf>

this point reads “... purchasing power from others ... would present additional resources that could play a part in the energy mix replacing the generation that would otherwise [would] have come from the retired units over at least short periods of time or for fairly limited capacity requirements.”

Interveners’ testimony in this statement is that in modeling no transactions with neighboring utilities, the Companies have produced potentially erroneous findings because the Companies can and do currently purchase energy from their neighbors. The Company is in a far better position to state the extent to which they can purchase energy from wholesale markets or through bilateral contracts.

25. What is a “sustainability target” level of CO2 emissions as used on page 1-19 in the report referenced in footnote 15 on page 20 of Dr. Fisher’s direct testimony?

**RESPONSE: Jeremy Fisher**

In the referenced AESC 2011 report, the sustainability target concept is described as follows

(Pages 6-93 – 6-94):

“The cost of control approach can also be based upon a “sustainability target” concept.

With the sustainability target, we start with a level of damage or risk that is considered to be acceptable, and then estimate the marginal cost of achieving that target. It is important to note that, at this stage in our collective understanding of the science of climate change, as well as its social, economic, and physical impacts, the notion of a “sustainability target” is a construct useful for discussion, but not yet firmly established.

The “sustainability target” approach relies on the assumption that the nations of the world will not tolerate unlimited damages. It also relies partly on an expectation that policy leaders will realize that it is cheaper to reduce emissions now and achieve a sustainability

target than it is not to address climate change. It is worth noting that a cost estimate based on a sustainability target will be a bit lower than a damage cost estimate because the “sustainability target” is going to be a calculus of what climate change the planet is already committed to, and what additional change we are willing to live with (again complicated by the fact that different regions will see different impacts, and have different ideas about what is dangerous and what is sustainable).”

The target utilized in the AESC report is based on not exceeding a temperature rise of 2°C above 2005 global average temperatures.

26. Please refer to Figure 1 on page 21 and Figure 2 on page 22 of Dr. Fisher’s direct testimony.

a. Please provide the underlying data in machine readable tabular format for each of the forecasts shown on Figure 1 and Figure 2.

b. Please state and explain the assumptions included in the AESC 2011 Henry Hub natural gas price forecast concerning the existing and proposed environmental regulations that are discussed on pages 11 and 12 of Dr. Fisher’s testimony (Section 3: Environmental Regulations Faced by LG&E/KU).

i. Are those assumptions consistent or inconsistent with the assumptions Dr. Fisher made regarding the same environmental regulations in the other parts of his analysis of the Companies’ filing? Please explain in detail.

ii. If Dr. Fisher’s assumptions about the environmental regulations discussed at pages 11-12 of his direct testimony are correct, will the likely effect of such regulations be to increase or decrease electrical generation’s contribution to the demand for natural gas? Will that likely affect on natural gas demand tend to increase or decrease natural gas prices? Please explain in detail.

c. Explain the underlying assumptions for CO2 regulations included in the AESC 2011 Henry Hub natural gas price forecast and explain whether those assumptions are consistent or inconsistent with the assumptions regarding CO2 regulations made by Dr. Fisher in the other aspects of his analysis of the Companies’ filing.

**RESPONSE: Jeremy Fisher**

a. Please see response to Companies’ Discovery Request 11

b. As found in the AESC report on pages 2-14 through 2-19 (section 2.2.3) and in Appendix C of the report, the environmental regulations reviewed include the [proposed] Clean Air Transport Rule, the Air Toxics [Rule], proposed Coal Combustion Residuals mitigation and regulation, the proposed water intake rule, the Regional Haze Rule, and RGGI and possible federal CO<sub>2</sub> regulations. While the report makes reference to PM, ozone, SO<sub>2</sub>, and NO<sub>x</sub> National Ambient Air Quality Standards (NAAQS), it does not include an extensive discussion of the implications of these regulations. The regulations inform, in part, the assumption of coal unit retirements over the analysis period, as seen in Exhibit 2-8 and sections 2-31 through 2-35.

- i. These assumptions are generally consistent with the assumptions made in my testimony. The Clean Air Transport Rule (CATR), as proposed, applied to two New England states (MA and CT). The final Cross State Air Pollution Rule (CSAPR) does not apply to New England states. The assumed emissions allowance prices for NO<sub>x</sub> and SO<sub>2</sub> in Exhibit 2-3 were based on assumptions made by the model vendor (Ventyx) based on the CATR. These emissions prices may need to be re-evaluated in light of New England's exclusion from the final rule.
- ii. Several groups, including the North American Reliability Corporation (NERC), Brattle, Bernstein, Credit Suisse, and Deutsche Bank, have all predicted that a suite of existing, proposed, and pending environmental regulations will lead to coal plant retirements. Intervenors are producing the reports referenced herein. Most of these projections have implied (although rarely explicitly) that the likely replacement power for retiring coal units will be natural gas fired. However,

decisions regarding replacement power, and which generators will produce that power (new or existing) will ultimately be made on a utility by utility basis.

Similarly to the KU/LG&E analysis results that predict that both coal and gas will pick up load requirements after retirements, it is probable that a combination of existing resources (both economic coal and gas) as well as new resources of multiple forms (including demand-side management) will meet requirements.

Consequently, the impact on natural gas prices is uncertain at this time without comprehensive system modeling, which was not conducted for this docket. One would have to evaluate if the amount of new gas generation resulting from economic coal retirements was sufficient to have a significant impact on gas demand, and hence prices.

- c. The base case CO<sub>2</sub> prices utilized in the AESC report are consistent with the “Mid Case” of the Synapse 2011 Carbon Dioxide Price Forecast, and hence with Dr. Fisher’s testimony. There is one exceptions to this consistency, not directly relevant to this proceeding: the AESC report has carried the current RGGI market price for CO<sub>2</sub> through to 2017, at which point it is assumed that federal legislation pre-empts RGGI.

27. Please refer to the document titled “Avoided Energy Supply Costs in New England: 2011 Report,” dated July 21, 2011 (as referenced in Footnote 15 on page 20 of Dr. Fisher’s direct testimony), which provides the basis for Dr. Fisher’s recommended gas forecast labeled “AESC 2011” in Figure 1 on page 21 of Dr. Fisher’s testimony.

- a. Please describe the intended purpose of this report and explain if it has been used by the sponsoring utilities in their analysis of the construction of emissions controls and/or coal unit retirements.

- b. Please provide the underlying data in machine readable tabular format for the following exhibits.

- i. Chapter 1 – Exhibits 1-2, 1-3, 1-5, 1-14, 1-15, and 1-16

- ii. Chapter 3 – Exhibits 3-4, 3-6, 3-8, 3-9, 3-10, 3-11, 3-12, 3-13, 3-14, 3-15

c. Referring to Exhibit 3-4 on page 3-9, please demonstrate how the monthly NYMEX futures gas prices were converted to the annual 2010 dollar values shown as part of the AESC 2011 forecast in Figure 1 on page 21 of Dr. Fisher's testimony. Please provide all assumptions made and workpapers used in that process.

d. Referring to page 3-14, please provide all documentation supporting the statement that "Our total uses a 50-50 weighting based on judgment and the approximate quantities of each category of reserves reported for 2010." Please explain the degree to which judgment was used in this process and demonstrate why the 50-50 weighting was judged to be appropriate.

e. Referring to page 3-14, please refer to the statement that "The net result of the rule changes is not clear but it may have increased PUDs." Please explain how this ambiguity around the impact of SEC rule changes was incorporated in the AESC 2011 Base Case gas price forecast or in the High Price or Low Price cases.

f. Referring to page 3-17, please refer to the following excerpt:

"There is some indication that the supply of natural gas from the U.S. may decline. The independent producers, particularly the large ones such as Chesapeake, Devon and EOG Resources, all plan to shift exploration and drilling to U.S. places where production will be liquids rich either for crude oil and condensate or at least larger volume NGL production associated with natural gas production. They plan to reduce drilling for dry gas. This shift appears to be under way."

Please explain how this ongoing shift in gas supply is incorporated in the AESC 2011 gas price forecast.

g. Referring to page 3-17, please refer to the statement that "The next step in developing a forecast of annual Henry Hub natural-gas prices is to review the forecasts available from AEO 2011 and AEO 2010 to determine which forecast is most consistent with our estimate of the Henry Hub price needed to cover the full-cost of shale gas." Please explain whether the AESC 2011 forecast is based on the assumptions in a specific AEO forecast or if a specific AEO forecast was chosen due to its similarity in results to Synapse's cost estimates.

h. Referring to page 3-18, please provide all documentation supporting the choice of the AEO 2010 High Shale Case as the basis for the AESC 2011 Base Case. Please explain the underlying assumption(s) for the size of the shale gas resource used.

i. Referring to page 3-20, please refer to the statement that "The estimate of the marginal cost of shale gas implicit in the various AEO 2011 cases are significantly less than our estimate of the full-cycle, all-in cost of finding, developing and producing shale gas." Does this statement imply that the AEO 2011 cases are less reliable than the AEO 2010 cases? How does Synapse ensure its cost estimates are more accurate than those in the AEO?

j. Referring to page 3-25, please refer to the statement, "The AESC High Price Case is drawn from the AEO 2010 Slow Oil & Gas Technology case." Please provide all documentation supporting the choice of this case as the "AESC 2011 High Price Case" compared to other potential AEO cases or compared to other forecasts considered by Synapse.

k. Referring to pages 3-25 and 3-26, please refer to the discussion of the "AESC 2011 Low Price Case."

i. Please refer to the statement on page 3-25, "The AESC 2011 Low Price case assumes a decrease in finding, development and production costs for natural gas due to developments in oil and gas technology 50% more rapid than in the Base Case." Please provide all documentation that supports using the 50% factor.

ii. Please explain why it is appropriate to use several forecasts and methods to develop the Low Price case over the different time periods of the forecast compared to using single AEO forecasts for the Base Case and High Price Case.

l. Referring to page 3-29, please refer to the statement, "However, other than the disclosure of chemicals in fracturing fluid, our review of the literature did not find any public projections of specific changes in existing Federal, state and local regulations, including scope and timing, from which to develop a credible estimate of a material impact on the cost of shale gas production." Please explain if any potential regulations regarding shale gas development were considered in the AESC 2011 Base Case, Low Price Case, or High Price Case. Also, please explain how this level of consideration is or is not appropriate and how it is or is not consistent with Dr. Fisher's expectations regarding other potential environmental regulations set forth in his testimony.

m. Please refer to the discussion on page 34 concerning the methodology used to quantify Henry Hub price volatility as shown in Exhibit 3-15. Please explain if this approach for measuring volatility is standard practice, and please cite other references in which this approach has been used.

**RESPONSE: Jeremy Fisher, Counsel**

Intervenors object that the information requested in Request 27 is not in their possession or control, as the Intervenors were not involved in the preparation of the AESC natural gas price forecast. In addition, Dr. Fisher was neither an author nor a participant in the AESC study, and does not have access to this information. Ms. Wilson was an author on the report, but her role in the study was restricted to configuring and operating the Market Analytics (PROSYM) model.

Subject to and without waiving this objection, Intervenors respond as follows:

Dr. Fisher chose to use the AESC forecast simply for internal consistency with the latest Synapse research. The forecast was prepared by an expert contracting with Synapse, and was vetted by the utilities and companies participating in the research. Intervenors would not object should the Companies instead choose to use a vetted public forecast, or, more specifically, a range of forecasts, such as are provided by the EIA in the Annual Energy Outlook.

While the question does not ask for Intervenors' review of the Companies' behavior with regard to natural gas forecasts, it is worth noting that Synapse has provided a forecast of natural gas prices with significant documentation and explanation. The forecast and its underlying



assumptions and basis are open for examination by the Companies, Staff, other interveners, and the public. The same cannot be said for the forecast provided by the Companies.<sup>7</sup>

- a. The AESC 2011 report describes its purpose in the first sentence of the executive summary: “This 2011 Avoided-Energy-Supply-Component Study (“AESC 2011,” or “the Study”) provides projections of marginal energy supply costs that will be avoided due to reductions in the use of electricity, natural gas, and other fuels resulting from energy efficiency programs offered to customers throughout New England.” It is unknown if the sponsoring utilities, including both gas providers and electric utilities, have used this report or component parts “in their analysis of the construction of emissions controls and/or coal unit retirements.”
- b. See objection above.
- c. See objection above. Subject to and without waiving the foregoing objection, Intervenors state that the forecast used in Dr. Fisher’s testimony was extracted from Exhibit D-4 of the AESC 2011 report, column “Annual Henry Hub Price” in 2011\$. See attachment to response to Question 11 for dollar conversion factors.
- d. See b, above.
- e. See b, above.
- f. See b, above.
- g. See b, above. Subject to and without waiving the foregoing objection, please see section 3.2.2.2 of the AESC 2011 report.

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<sup>7</sup> The Companies only provided fuel price forecasts as ancillary information in response to intervener discovery. The Companies appear to have changed this forecast in a Supplemental Analysis supplied only 48 hours before intervener testimony, and yet have even redacted even the final gas price forecast from confidential documents. There is no accompanying documentation supporting these forecasts, and the references the forecasts are only given annual dates (2011), although it is clear that all three consultancies regularly update their medium and long-term forecasts as required, even if more regularly than on an annual basis.

- h. See b, above.
- i. See b, above.
- j. See b, above. Subject to and without waiving the foregoing objection, please note that the “High Natural Gas Price” is roughly similar to the Wood Mackenzie price trajectory used by the Companies in the Supplemental Analysis.
- k. See b, above.
- l. See b, above. Subject to and without waiving the foregoing objection, Intervenors state that in regards to the second clause of this discovery request, due consideration should be given to the mitigation of environmental and safety concerns from natural gas extraction. However, as the quoted statement implies, it is not clear what form environmental regulations might take in natural gas drilling, and we are not aware of price projections that explicitly take into account these unknown regulations. In September 2011, the New York State Department of Environmental Conservation released a revised Draft Supplemental Generic Environmental Impact Statement (SGEIS) on the environmental concerns associated with shale gas production and “fracking”, as well as potential mitigation opportunities.<sup>8</sup> It is unclear how the mitigation measures would impact long-term natural gas price forecasts, if at all.
- m. See b, above.

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<sup>8</sup> Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program (September 2011). <http://www.dec.ny.gov/energy/75370.html>

these technologies. Generally, SCR is considered a highly effective technology for reducing NOx emissions.

31. Please refer to Dr. Fisher’s direct testimony at page 26, lines 5-7. Please provide all analysis supporting the statement, “[T]he operational plants that do not have SCR will require this control technology (Brown 1 & 2, Ghent 2, and Mill Creek 1 & 2), to meet local attainment.” If no analysis was performed, what is the basis for the statement made?

**RESPONSE: Jeremy Fisher**

Please see response to Commission Staff Discovery Request 9a.

32. Please refer to Dr. Fisher’s direct testimony at page 27, lines 18-20. Please provide all analysis supporting the statement, “[T]he ozone NAAQS will require SCR on the Companies coal plants.” If no analysis was performed, what is the basis for the statement?

**RESPONSE: Jeremy Fisher**

Please see response to Commission Staff Discovery Request 9a.

33. Please refer to Dr. Fisher’s direct testimony at page 33, lines 7-11. For each of the five concerns listed, please provide all documentation, analysis, and reports that justify and validate each concern.

**RESPONSE: Jeremy Fisher**

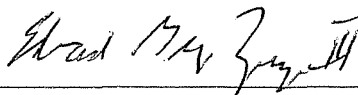
Please refer to Dr. Fisher’s direct testimony, pages 33 through 40. Also, see responses to Companies’ Discovery Requests 3, 4, 23, and 24, and response to Staff Discovery Request 2.

34. Please refer to Rachel Wilson’s direct testimony at page 5. Please provide all output reports and documents that demonstrate in detail that she was “able to exactly reproduce the Companies’ results.”

**RESPONSE: Rachel Wilson**

Please see attached data files in subfolder “KU Replication”. Note version release date (September 7, 2011). Files were opened and re-saved during discovery process, so timestamps in REP files read 10/12/2011. If requested, Synapse can provide on-site verification that the Strategist model, as operated at Synapse, can “exactly reproduce the Companies’ results.”

Respectfully submitted,



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Edward George Zuger III, Esq.  
Zuger Law Office PLLC  
Post Office Box 728  
Corbin, Kentucky 40702  
(606) 416-9474

Of counsel:

Shannon Fisk  
Senior Attorney  
Natural Resources Defense Council  
2 N. Riverside Plaza, Suite 2250  
Chicago, IL 60606  
Phone: (312) 651-7904  
Fax: (312) 234-9633  
sfisk@nrdc.org

Kristin Henry  
Staff Attorney  
Sierra Club  
85 Second Street  
San Francisco, CA 94105  
Phone: (415) 977-5716  
Fax: (415) 977-5793  
kristin.henry@sierraclub.org

Dated: October 13, 2011

## CERTIFICATE OF SERVICE

I certify that I mailed a copy of these Responses and Objections by first class mail on October 13, 2011 to the following:

Lonnie Bellar  
Vice President, State Regulation & Rates  
LG&E and KU Services Company  
220 West Main Street  
Louisville, KY 40202

Allyson K. Sturgeon  
Senior Corporate Attorney  
Louisville Gas & Electric and Kentucky  
Utilities  
220 West Main Street  
Louisville, KY 40202

Robert M. Conroy  
Director, Rates  
Louisville Gas & Electric and Kentucky  
Utilities Company  
220 W. Main Street  
P.O. Box 32010  
Louisville, KY 40232-2010

Kendrick R. Riggs, Esq.  
Stoll, Keenon & Odgen, PLLC  
2000 PNC Plaza  
500 West Jefferson Street  
Louisville, KY 40202

Dennis G. Howard II  
Lawrence W. Cook  
Attorney General's Office of Rate  
Intervention  
1024 Capital Center Drive, Suite 200  
Frankfort, KY 40601-8204

Michael L. Kurtz  
Kurt J. Boehm  
Boehm, Kurtz & Lowry  
36 East Seventh Street, Suite 1510  
Cincinnati, OH 45202

David J. Barberie, Attorney Senior  
Leslye M. Bowman, Director of Litigation  
Government Center (LFUCG)  
Department of Law  
200 East Main Street  
Lexington, KY 40507

Iris G. Skidmore  
415 West Main Street, Suite 2  
Frankfort, KY 40601

David C. Brown, Esq.  
Stites & Harbison, PLLC  
400 W. Market Street, Suite 1800  
Louisville, KY 40202

Tom FitzGerald  
P. O. Box 1070  
Frankfort, KY 40602

Robert A. Ganton, Esq.  
General Attorney - Regulatory Law  
U. S. Army Legal Services Agency  
9275 Gunston Road  
ATTN: JALS-RL/IP  
Fort Belvoir, VA 22060-5546







