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March 26, 2008

From: Mary Galligan
Raney Gilliland

Re: Gardner Intermodal Project

You asked our office to identify for you the "carbon footprint" of the proposed intermodal logistics development in Gardner, KS. The request in particular asked for an assessment of the potential increase in CO_2 emissions attributable to the facility as compared to the expected CO_2 emissions from the proposed Sunflower Electric Power Corporation expansion.

In order to reply to your request, we contacted a number of entities and reviewed a number of pertinent publications.[1] We are unable to make an accurate estimate of increased CO_2 in the atmosphere, if any, attributable solely to the Gardner facility from publically available information we have reviewed. The number of variables that impact CO_2 emissions in the context of freight transportation and handling makes it virtually impossible for this Department to make a definitive assessment. We also would note that "carbon footprint" is not a recognized scientific concept for which there is a standard analysis methodology.[2] The discussion that follows describes some of the considerations and possible scenarios that may inform your thinking about the environmental impact of a transportation project as compared to an electricity generation project.

Gardner Project Background

The proposed intermodal transportation center at Gardner is a project of the BNSF Railroad. Currently, the US Army Corps of Engineers is developing an environmental assessment for the project. That analysis is expected to be completed by early in the fall of 2008.[3] The environmental assessment may not address CO_2 emissions because the issue in question is relocation of a tributary of Big Bull Creek. In addition, CO_2 is not currently regulated by the Environmental

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[1] We contacted the Kansas Department of Health and Environment (KDHE), the federal Environmental Protection Agency (EPA), the BNSF Railroad, HDR (a consulting firm under contract to BNSF and Sunflower Electric Power Corporation), the Mid America Regional Council (MARC), and the Kansas Department of Transportation (KDOT). In addition, we reviewed material published by the US Department of Transportation Federal Highway Administration, KDOT, the City of Gardner, HDR, the National Surface Transportation Policy and Revenue Study Commission, the Federal Highway Administration and the New York State Department of Transportation, the US Environmental Protection Agency, the River Valley Regional Intermodal Facilities Authority and the Arkansas State Highway and Transportation Department in cooperation with the US Army Corps of Engineers, Association of American Railroads, the Intermodal Review Committee of the Gardner City Council, a memorandum provided by ENVIRON (a BNSF consultant), and numerous articles from the *Kansas City Star*.

[2] "Despite its ubiquitous use however, there is an apparent lack of academic definitions of what exactly a 'carbon footprint' is meant to be. The scientific literature is surprisingly void of clarifications, despite the fact that countless studies in energy and ecological economics that could have claimed to measure a 'carbon footprint' have been published over decades."
ISA[UK] Research Report 07-01. Accessed at: www.isa-research.co.uk. March 15, 2008.

[3] E-mail from Skip Kalb, BNSF, March 16, 2008.

Protection Agency, so may well not be included in the assessment. The Gardner facility is projected to open late in 2009 or early in 2010.[4]

The scope of the Gardner project includes relocation of certain functions from the BNSF facility in the Argentine Yard in Kansas City, Kansas. Those functions primarily are the containerized freight handling operations. According to BNSF officials, the move is necessary because the containerized freight handling capacity of the Argentine Yard has been reached. The Argentine Yard will continue to be used as a classification facility.[5]

Background -- Freight Shipment To/From Kansas City Metropolitan Area

According to information published by the US Department of Transportation Federal Highway Administration, freight shipments by rail to, from, and within Kansas are projected to grow from 58 million tons in 1998 to 80 million tons in 2010 (the year the Gardner facility is expected to open) to 98 million tons in 2020. That increase would be 68 percent over the 22 year period. Projected truck freight movement for those same years show an increase from 190 million tons in 1998 to 311 million tons in 2020, a 64 percent increase during the period. Currently, most freight in Kansas is carried by trucks and these projections indicate that will continue to be the case in the foreseeable future. Secondary traffic, freight moved to and from distribution centers or through intermodal facilities, such as the proposed facility at Gardner, are projected to become a larger part of freight shipments in Kansas by 2020. In 1998 secondary freight traffic involved 15 million tons of freight moved to, from, and within the state. That amount was the least of the top five commodities shipped. By 2020, secondary traffic is projected to involve 44 million tons of goods, third in the ranking behind farm products and food products.[6]

Increase in Container Handling Capacity

The container handling capacity at the Argentine Yard currently ranges from 375,000 to 415,000 containers per year. The most recent information from BNSF shows the Gardner facility is projected to have a capacity of 450,000 to 490,000 containers in 2015 and 790,000 to 870,000 containers in 2030. Each container is moved from the rail yard on a truck, so the number of containers equates to the number of truck-trips moving freight from the yard. Based on those figures, the increase in the number of truck-trips would be 35,000 to 115,000 in 2015 and 375,000 to 495,000 in 2030.[7] Using a formula for deriving the weekday truck volume from the number of containers, the resulting increase in truck traffic is predicted to range from 132 to 434 trucks per weekday in 2015 to 1,415 to 1,868 trucks per weekday in 2030.[8] Previous site-specific traffic analyses used slightly different figures and were not based on the projected increase in freight movement.[9]

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[4] Conversation with Skip Kalb, BNSF, March 12, 2008.

[5] Conversation with Skip Kalb, BNSF. March 12, 2008

[6] US Department of Transportation Federal Highway Administration. "Freight News: Freight Transportation Profile -- Kansas Freight Analysis Framework." November 2002. Accessed at: http://www.ops.fhwa.dot.gov/freight/freight_analysis/state_info/kansas/ks2.pdf. March 8, 2008.

[7] Memorandum from Environ to Skip Kalb and Russell Light, BNSF. March 14, 2008.

[8] HDR. *Traffic Study of the Proposed Logistics Park in Johnson County, KS*. Prepared for BNSF (HDR Traffic Study). March 14, 2006. Formula: weekday truck volume = (annual lifts/52)x 1.09x0.18 = annual lifts x 0.003773. Accessed at http://www.gardnerkansas.gov/html/asset/Administration/BNSFGardnerTransportationReport.pdf. March 15, 2008.

[9] HDR Traffic Study.

Considering CO_2 Emissions

Since there is no standard methodology for identifying a "carbon footprint", one might look at the question of increased CO_2 emissions using a number of assumptions. Unfortunately, the dearth of data makes it impossible to derive figures based on these assumptions. Two different perspectives are briefly described below for your consideration. This discussion is intended to illustrate the effect of different assumptions on any estimates of CO_2 emissions.

Isolated impact of Gardner facility

One approach would be to attempt to derive an estimate of CO_2 emissions attributable to the projected freight traffic increase in the Kansas City region based on the product of the anticipated increase in truck trips and the distance traveled in each trip. We have not identified a reliable source of information to determine the two key variables in such a calculation: the number of and length of trips and the amount of fuel consumed per trip.

Even if those data were available, there would be a problem with the approach. That is, such a simplistic calculation would not account for the full scope of any changes in freight traffic in and around the Kansas City metropolitan area that will result from projected general growth in the industry. In particular, any efficiencies that would be realized by trucking companies using the Gardner facility would not be included in such a calculation. For example, variables that impact CO_2 emissions such as congestion in the center of the city, and distances from the Argentine Yard to warehouse facilities and the final destination of goods would not be included in the calculation.

Further, a simple calculation as described above would not account for any CO_2 emissions resulting from the construction of the facility or the impact of the use of any “less efficient traffic routes and slower speeds due to increased traffic congestion”[10] during construction. While previous traffic studies have included estimates of traffic generated by employees moving to and from the site, it is virtually impossible to determine whether those employees' trips would represent a net increase in total vehicle trips or distances traveled within the metropolitan area. For that reason, it may be difficult to allocate any estimate CO_2 emissions specifically to the Gardner facility.

Use of this approach also would imply that any increased CO_2 emissions are caused by the existence of the Gardner facility. In fact, we have not identified any data that point to such a causal relationship between CO_2 emissions and specific facilities. The increase in demand for freight transport is driven by factors outside the control of either rail or trucking companies. Any increase in train or truck traffic is a natural outgrowth of changes in the flow of goods into, out of and within the US.[11] Freight shipping volume will increase truck traffic in response to increased consumer demand generated in part by growth of the Kansas City metropolitan area.[12] Recent environmental

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[10] Letter from KDHE to US Army Corps of Engineers September 10, 2007. Accessed at: http://www.nwk.usace.army.mil/regulatory/BNSF/KDHE.pdf. March 15, 2008.

[11] US Department of Transportation Federal Highway Administration Office of Freight Management and Operations. *Freight News: Freight Analysis Framework*. October 2002. Accessed at: http://ops.fhwa.dot.gov/freight/documents/faf_overview.pdf. March 12, 2008.

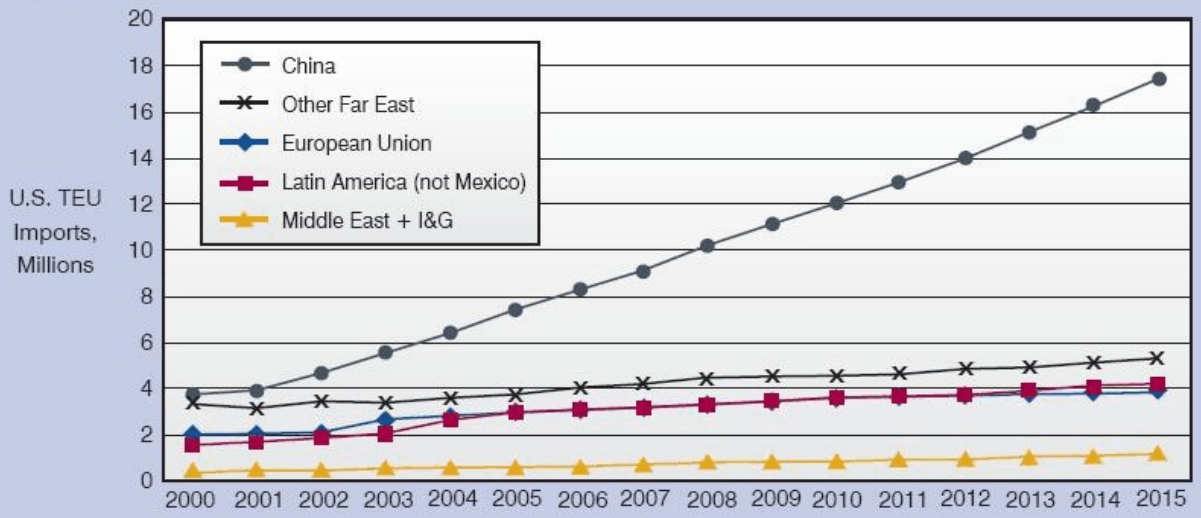
[12] “Between 2000 and 2030 the region’s population will grow from 1,695,764 to 2,248,933, or 32.6%. At the same time, the number of households will grow by 42.8%, and the number of jobs (including both part- and full-time wage and salary earners and business owners) will grow by 52%.” 2004 Long Range Forecast for the Kansas City Metropolitan Area. 2004_Long_Range_Forecast.xls. Accessed at http://www.metrodataline.org/longrangekc.htm. March 15, 2008.

impact assessments of other intermodal facilities regarding air pollution have shown no anticipated increases caused by the facilities.[13]

Systemic shift in mode of freight transportation

A second perspective might begin with an assumption that if BNSF facilities are not able to handle the projected increase of freight traffic, all or a significant portion of that freight will be moved via truck rather than train. The major increase in freight traffic flow in recent years that has potential to impact the Kansas City area has been from the west coast and Mexico to points north and east of Kansas City. Those major flows of goods will continue to grow at least for the foreseeable future as depicted in the graphic below from the 2007 Report of the National Surface Transportation Policy and Revenue Study Commission.[14]

Exhibit 2-9. Projected growth in container imports to the U.S. merchandise trade by export region, 2000–2015



This chart shows that containerized imports have grown dramatically in recent years, particularly from China. The growing dominance of China in the containerized trade is expected to continue in the future.

Sources: Global Insight World Trade Service

One result of an analysis based on this perspective is included in the attached memorandum from ENVIRON, a consulting firm engaged by BNSF. This assumption generalizes shipper behavior to a "trains or trucks" choice. In fact, under some circumstances, constrained capacity at one

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[13] US Department of Transportation Federal Highway Administration and New York State Department of Transportation. *Design Report/draft Environmental Impact Statement*. May 2007. Accessed at: https://www.nysdot.gov/portal/page/portal/regional-offices/region10/repository/intermodal/deis.html. March 7, 2008. US Department of Transportation Federal Highway Administration, River Valley Regional Intermodal Facilities Authority, and the Arkansas State Highway and Transportation Department in cooperation with the Little Rock District US Army Corps of Engineers. *River Valley Intermodal Facilities Draft Environmental Impact Statement.* February 2006. Accessed at: http://www.rivervalleyintermodal.org/deis.htm. March 7, 2008.

[14] National Surface Transportation Policy and Revenue Study Commission. *Transportation for Tomorrow.* December 2007. Page 2-12. Accessed at: http://www.transportationfortomorrow.org/final_report/. March 9, 2008.

railroad may result in a shift to another railroad.[15] However, there are realistically only two options, trains and trucks, for long distance freight movement to or from east or west coast ports to the central portion of the country.[16]

As you know, CO_2 is not a regulated gas, so most discussions of air pollution do not encompass measurements of CO_2 emissions. The ENVIRON memorandum shows the relationship between CO_2 emissions that would be expected from shipment by rail versus truck of the additional expected amount of BNSF-transported freight arriving in Kansas City in 2015 and 2030.

The necessity for improved efficiency in the transportation sector is well documented. According to the *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, published by the US Environmental Protection Agency in 2006, "The transportation industry in the US is a major emitter of greenhouse gases, including CO_2. . . . The transportation end-use sector accounted for 1,860.2 [teragram] CO_2 in 2004, or approximately 33 percent of total CO_2 emissions from fossil fuel combustion, the largest share of any end-use economic sector.[17] Between 1990 and 2004, transportation CO_2 emissions increased by 395.8 [teragram] CO_2, representing approximately 40 percent of the growth in energy-related CO_2 emissions from all sectors. Almost all of the energy consumed in the transportation sector was petroleum-based, including motor gasoline, diesel fuel, jet fuel, and residual oil."[18] A table from the Greenhouse Gas Inventory is reproduced below.

Table 3-4: Annual Change in CO_2 Emissions from Fossil Fuel Combustion for Selected Fuels and Sectors (Tg CO_2 Eq. and Percent)

Sector	Fuel Type	2000 to 2001		2001 to 2002		2002 to 2003		2003 to 2004	
Electricity Generation	Coal	-50.7	-3%	3.8	0%	37.5	2%	9.9	1%
Electricity Generation	Natural Gas	8.2	3%	16.1	6%	-28.0	-9%	18.2	7%
Electricity Generation	Petroleum	10.5	12%	-23.7	-23%	19.2	25%	0.3	0%
Transportation[a]	Petroleum	-11.7	-1%	42.0	2%	2.0	0%	54.3	3%
Residential	Natural Gas	-10.2	-4%	6.6	3%	11.4	4%	-11.4	-4%
Commercial	Natural Gas	-6.9	-4%	5.9	4%	4.6	3%	-12.7	-7%
Industrial	Coal	-1.1	-1%	-9.7	-8%	1.4	1%	-0.7	-1%
Industrial	Natural Gas	-36.8	-8%	6.3	1%	-15.0	-3%	12.3	3%
All Sectors[b]	All Fuels[b]	-46.8	-1%	14.9	0%	69.3	1%	85.5	2%

[a] Excludes emissions from International Bunker Fuels.
[b] Includes fuels and sectors not shown in table.

In regard to air pollution generated by different modes of freight transportation, a study published in 2005 by the US Department of Transportation Federal Highway Administration stated that "heavy-duty vehicles (trucks) are by far the largest contributor to freight emissions nationally, producing two-thirds of the NOx and PM-10 from the freight sector. Marine vessels are the next largest source, accounting for 18 percent of freight NOx emissions and 24 percent of freight PM-10

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[15] We note that last week an intermodal facility was opened by Kansas City Southern Railroad on the southeast side of the metropolitan area. See Kansas City Star "Kansas City Southern and partners to launch intermodal hub" March 13, 2008. Accessed at: http://www.kansascity.com/business/story/530440.html. March 13. 2008.

[16] Some freight is moved by air, but that generally is cost prohibitive for the majority of freight. In some parts of the country, along the Great Lakes and the major rivers, ships and barges are a freight-hauling option.

[17] This analysis did not consider electricity generation an "end-use economic sector." The report notes that "electricity generation is actually the largest emitter of CO_2 when electricity is not distributed among end-use sectors." *US Environmental Protection Agency. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004* (*Greenhouse Gas Inventory*) USEPA #430-R-06-002. April 2006. Energy 3-8. Accessed at: http://www.epa.gov/climatechange/emissions/usinventoryreport.html. March 9, 2008.

[18] *Greenhouse Gas Inventory.* Energy 3-8.

emissions, followed by railroads at 15 percent of NOx and 12 percent of PM-10. Air freight accounts for only 0.1 to 0.2 percent of total freight emissions of NOx and PM-10, respectively."[19]

We hope this information is useful to you. If you have additional questions, please feel free to contact either of us.

MKG/RG/jal

Enclosure

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[19] US Department of Transportation Federal Highway Administration. *Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level Final Report*. April 2005. Accessed at: http://www.fhwa.dot.gov/Environment/freightaq/index.htm. March 14, 2008.

ENVIRON

MEMORANDUM

To: Skip Kalb and Russell Light

From: Chris Lindhjem, ENVIRON

Date: March 14, 2008

Subject: Truck and Rail Freight Movement Comparisons

Summary Results

Using widely available figures for truck and rail fuel economy, estimates of increased container capacity with a new rail facility in the Kansas City area, and origination/destination, the potential fuel savings results in a CO2 savings ranging from 65,000 to 274,000 tons in the year 2015 rising to 700,000 to 1,200,000 tons in 2030.

Introduction to Method

In order to compare truck and rail fuel use for movements of freight (container), ENVIRON conducted an analysis comparing truck and rail movements of containers from Los Angeles to Kansas City. Without the Gardner facility, it is likely that the increase in rail capacity would otherwise need to be transported by truck. In order to provide an estimate of fuel consumption, the relative fuel consumption of transporting one container was calculated and scaled to the range of excess capacity to be available at Gardner for truck and rail movements.

The truck fuel economy and the rail freight efficiency multiplied by the mileage and the added capacity at Gardner outline the potential fuel savings that are converted to CO2 reductions.

Truck Fuel Consumption

For a heavy-duty diesel truck capable of carrying one container, the fuel economy is 6.30 mpg for the most modern truck type. This figure comes from EPA report for their greenhouse gas model, "Updating Fuel Economy Estimates in MOBILE6.3", found at http://www.epa.gov/otaq/models/mobile6/p02005.pdf

Train Fuel Consumption

The average BNSF fuel consumption in 2005 was 424 revenue ton-miles per gallon. Using a typical container weight of about 12 tons, the equivalent fuel economy, the equivalent fuel consumption to carry one container a mile is 35.3 mpg. Truck curb weights and chassis are typically about 30,000 pounds and the maximum weight for an on-road truck is 80,000 pounds gross vehicle weight leaving at most 24 tons for the container as a maximum weight. Therefore at worst, the relative fuel economy of rail would be 17.6 mpg equivalent for carrying one container.

The fuel economy figures for BNSF rail operations were found in the Association of American Railroads' (AAR) "Analysis of Class I Railroads, 2005" and are compilations of reports that the railroads are required to report annually to the Federal Railroad Administration (FRA).

Driving Distance

The driving distance from Los Angeles to Kansas City was estimated as 1619 miles from a road atlas.

Increased Container Capacity

From the BNSF verified statement (Brian Decker, February 15, 2008), the Argentine capacity was estimated as 375,000 to 415,000 lifts (lifts is another term for a container moving through an intermodal rail yard). From the same statement, the Gardner capacity was forecasted to be 450,000 to 490,000 lifts in 2015 and 790,000 to 870,000 in 2030.

Therefore the increased rail capacity was forecasted to range from 35,000 to 115,000 lifts in 2015 or 375,000 to 495,000 in 2030.

Conversion from Gallons to CO2

One gallon of diesel fuel is approximately 7.1 lbs. Based on the carbon and hydrogen content of fuel of 1.8 hydrogen atoms per carbon atom, the conversion to CO2 from fuel carbon is 44 / 13.8 or 3.19. So each gallon of diesel fuel burned corresponds 22.6 lbs of CO2

All figures for fuel density and fuel carbon content were found in the Code of Federal Regulations – 40 – Part 86.

Total CO2 Saved

By combining the range in forecasted container traffic with the mileage, truck fuel economy, and range in rail fuel economy, the range in fuel and CO2 savings are shown in Table 1. The lowest savings are due to the lowest increase in rail capacity and the worst-case rail fuel economy estimate.

Table 1. Combined fuel and CO2 savings for new rail capacity.

Year	Added Capacity (Containers)	Truck (gallons)	Rail (gal)[1]	Fuel Savings (gallons)	CO2 Savings (tons)
2015	35,000	8,994,444	3,210,482	5,783,963	65,359
	115,000	29,553,175	5,274,363	24,278,812	274,351
2030	375,000	96,369,048	34,398,017	61,971,031	700,273
	495,000	127,207,143	22,702,691	104,504,452	1,180,900

[1] – Range of rail fuel economy included in estimates.