

Peer Review of EPA's "Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping" Study

Work Assignment 3-05 (RTI 005)

Technical Memorandum

Prepared for

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TO: Lauren Steele, (Environmental Engineer) U.S. Environmental Protection Agency,
Office of Transportation and Air Quality (OTAQ)

FROM: Alex Rogozhin, RTI International.

DATE: January 28, 2011.

SUBJECT: Peer-Review of EPA's "Economic Impacts of the Category 3 Marine Rule on
Great Lakes Shipping" Study

1. Background

The U.S. Environmental Protection Agency's (EPA's) Office of Transportation and Air Quality recently finalized regulations addressing emissions from Category 3 marine diesel engines and their fuels (the C3 Marine Rule, 83 FR 22896, April 30, 2010). That rule contains EPA's coordinated strategy to address these emissions through a combination of national and international actions. As EPA developed the C3 Marine Rule, stakeholders from the Great Lakes shipping industry expressed their concerns that the proposed program, particularly the fuel sulfur limits, would lead to higher operating costs for ships operating on the Great Lakes. They further commented that this would lead to a transportation mode shift away from ships and toward trucks or rail, with concerns that the result could actually be an increase in emissions—the opposite of what EPA sought to accomplish. They also indicated that the increased operating costs could lead to a source shift for the crushed stone market and a production shift for steel manufacturing, which would also adversely affect Great Lakes shipping.

EPA did not change its final rule with regard to applying the C3 marine engine standards and fuel sulfur limits to the Great Lakes. In response to the comments, EPA performed an analysis of the economic impact of the C3 Marine Rule on Great Lakes shipping ("Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping," called "the EPA Report"). The EPA Report includes an analysis of transportation mode shift analysis, performed by ICF International and Energy and Environmental Research Associates, LLC (EERA), and source shift and production shift analyses performed by EPA. EPA submitted the Report for peer review, seeking the reviewers' expert opinion on the methodologies employed and analyses presented in the report and whether the impacts and effects described reflect a solid understanding of the effects of the C3 Marine Rule on Great Lakes shipping. RTI International facilitated this peer review, and this memorandum contains a summary of the peer review results as well as documentation of the peer-review process.

2. Description of the Peer-Review Process

EPA's Office of Transportation and Air Quality contacted RTI in October 2010 to facilitate the peer review of the EPA Report titled "Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping." EPA provided RTI a non-comprehensive list of subject matter experts from academia and the public sector (Appendix A of the performance work statement, WA 2-05), and this served as a starting point from which RTI assembled the list of subject matter experts. Even though EPA provided a non-comprehensive list of subject matter experts, the final list of 16 potential reviewers was compiled by RTI without consultation with EPA. To ensure that the work would be completed in a timely manner, RTI contacted the potential reviewers within a week of submitting the work plan and determined whether each expert would be able to review the study during the period of performance. RTI selected three independent (as defined in Sections 1.2.6 and 1.2.7 of EPA's *Peer Review Handbook*) subject matter experts based on the following criteria in order of importance: 1) expertise in subject matter, 2) diversity of backgrounds of the reviewers as a group, and 3) availability to perform the review in the stipulated time frame. When one of the initially selected reviewers later declined to participate, RTI selected an alternate reviewer from the list of 16 potential subject matter experts. To make the review process as credible as possible, RTI did not consult EPA in selecting the final reviewers.

The selected reviewers possess a range of expertise in maritime operations, transportation planning and logistics, economic analysis, environmental issues, and the effect of transportation on economic development. Appendix A of this technical memorandum provides the resumes obtained from the selected reviewers. The selected reviewers have sufficient knowledge in: 1) economics, 2) water transportation, 3) transportation logistics, and 4) regulation analysis to evaluate the three methodologies (mode-shift analysis, source shift analysis, and production shift analysis) used in the EPA Report.

RTI provided each of the reviewers with a copy of the EPA Report. The reviewers were also given a set of charge questions prepared by the EPA as well as several supporting documents (the list of additional documents provided to the reviewers is available in Appendix F). The note along with the set of charge questions sent from RTI to the reviewers is included in Appendix B of this memorandum.

After 3 weeks of the review process, a telephone conference call was organized between EPA, the reviewers, and RTI. The purpose of the telephone conference was to provide an opportunity for the reviewers to discuss any questions or concerns regarding the review material and the expected deliverables. Some of the questions addressed in this process are included in Appendix C of this memorandum. Additionally, one of the reviewers had further questions

regarding the study. A second telephone conference was held between EPA, the reviewer, and RTI with the purpose to address those questions. The telephone conference was documented, and the log of the conference was later shared with the other reviewers. The log of the second conference call is included in Appendix C.

RTI received the review reports from the reviewers and forwarded the reports to EPA by the requested date. The review reports included the responses to the charge questions and any additional comments or recommendations. From each reviewer, RTI obtained a cover letter that stated the reviewer's name, the name and address of his/her organization, the documents that were received and reviewed by the reviewer, and a statement of any real or perceived conflict(s) of interest. These cover letters and the review reports are included in Appendices D and E of this memorandum.

3. Summary of the Peer-Review Comments

The EPA Report consists of seven chapters and various appendices. The reviewers were asked to comment on the report as a whole but to focus on Chapters 2, 3, and the Appendices to those chapters. Chapter 2 contains the analysis of the potential for transportation mode shift on the Great Lakes as a result of compliance with the Category 3 rule. Chapter 3 contains the analysis of the potential for source shift and production shifts, as well as the emission impacts of transportation mode shift, were it to occur. The remainder of the EPA Report consists of general information about EPA's marine emissions control program (Chapter 1) as well as information specific to the Great Lakes with regard to estimated emission inventories (Chapter 4), estimated air quality impacts and human health and welfare benefits associated with the Category 3 rule (Chapter 5), estimated compliance costs for Category 3 ships on the Great Lakes (Chapter 6), and an industry characterization (Chapter 7).

With regard to Chapters 2 and 3, the reviewers were asked to focus their reviews primarily on the following issues raised by charge questions: 1) clarity of the presentation, 2) the overall approach and methodology, 3) appropriateness of the datasets and other inputs, 4) the data analyses conducted, and 5) appropriateness of the conclusions. Reviewers organized their review reports by first addressing each of the five issues mentioned above, and then providing a list of page-by-page comments. This memorandum provides a summary of the comments received from the three reviewers: Dr. Michael Belzer (Wayne State University), Dr. Bradley Hull (John Carroll University), and Mr. James Kruse (Texas Transportation Institute).

This memorandum is structured as follows: Section 3.1 provides an overview of all the peer-review reports, Section 3.2 summarizes comments on clarity and presentation of the EPA Report, Section 3.3 summarizes comments on the overall approach and methodology, Section 3.4

summarizes comments on the appropriateness of the datasets and other inputs, Section 3.5 summarizes comments on the data analyses conducted, Section 3.6 summarizes comments on appropriateness of the conclusions, and Section 3.7 summarizes any other comments provided by reviewers. Interested readers should refer to Appendix E for the full text of the comments.

3.1 Overview of the Reviewers' Comments

The reviewers found the EPA Report to be comprehensive and well substantiated. With respect to *clarity of presentation*, the reviewers generally noted that the EPA Report is well written and easy to follow.

With respect to *methodology*, the reviewers commented that the methodology chosen is appropriate but had some suggestions about some of the methodology assumptions. One of the reviewers suggested improving mode shift analysis by addressing the impacts of a global trade on three commodities (grain, steel coils, and containers). Another reviewer suggested that a cost-benefit analysis would have been sufficient to justify environmental action.

Reviewers' most substantive critique was of the *inputs* to the analysis. All reviewers emphasized the need for better documentation of some of the inputs and further explanation of how several other inputs were derived.

While the reviewers commented that the *conclusions* drawn from the study were appropriate, they suggested providing further evidence and explanation for some of them. One reviewer suggested validating the applicability of the assumptions in the real world by discussing inputs, analysis, and conclusions of a subset of 16 selected scenarios with the stakeholders.

3.2 Clarity of the Presentation

The reviewers generally noted that the EPA Report is well written and easy to follow. The reviewers provided suggestions to improve overall readability and clarity to a general audience. Some of their suggestions are summarized in this section.

Dr. Belzer suggested changing wording and clarifying several passages in Chapter 3. For example, he suggested attributing the argument about a negligible increase in price of commodities (except stone) to "down-market competition" in the last paragraph on page 3-13. He also recommended providing a reference for an assumption that "marine carriers have empty backhauls" in the first paragraph on page 3-20. Finally, Dr. Belzer suggested portraying marine emissions in Table 3-9 on page 3-20 in the manner similar to locomotive emissions in Table 3-11 on page 3-22. He explained that it seems that locomotive and marine emission calculations are in different denominations, and that makes it hard for a reader to compare the two.

Dr. Hull suggested stating clearly early in the EPA Report that the study addresses sulfur limits only, because readers might question why only sulfur limits are addressed in the EPA Report, while the report also includes details on NO_x and particulate matter. He proposed clarifying the jurisdiction of the C3 Marine Rule, and suggested adding a convincing argument that ships are among the major contributors to sulfur pollution in the Great Lakes/St. Lawrence region (he suggested providing a table that lists sulfur emissions from ships, trucks, railroads, automobiles, and manufacturers in the Great Lakes). He added that readers need to be convinced that even though a majority of marine emissions take place in unpopulated areas, populated areas are affected as well.

Dr. Hull also suggested clarifying “whether the Seaway between Montreal and the mouth of the St. Lawrence River will require 100% MDO” and requested to perform a due diligence analysis to determine whether sufficient quantities of MDO exist to support the C3 Marine Rule. Finally, he suggested distinguishing clearly between the terms “rates” and “costs” throughout the entire report.

Mr. Kruse mentioned that it would be helpful to standardize the units of measures for tons, as terms such as “tonnes,” “tons,” “metric tons,” and “short tons” are used throughout the report. He suggested spelling out acronyms when they are introduced in the report for the first time, such as “BAU” on page 1-12. He recommended providing explanation for the statement “the analysis does not consider the transportation of the grain from the farm to the silo” on page 2-9. Mr. Kruse also suggested stating the fact that in some cases the origin/destination points are not serviceable by rail in the beginning Appendix A to Chapter 2 versus, as it stands now, at the end of the report in the results section. Mr. Kruse commented that the following two statements were important and suggested adding them to the executive summary: 1) “The purpose of this study is to examine whether an increase in fuel costs for Great Lakes shipping could lead to transportation mode shift” on page 2-6, and 2) an explanation of how the freight comparison was conducted on page 2-16.

3.3 Overall Approach and Methodology

Overall reviewers concurred with the selected methodology. With respect to the origin/destination pairs, Dr. Belzer raised a concern that the 16 routes that were used in the analysis were not randomly selected from about 50 cases suggested by the industry. He mentioned that one potentially could assume that EPA selected “the cases with [the] least likelihood of modal shift.” However, Dr. Belzer argued that since 50 cases were proposed by the industry that in general objects to the C3 Marine Rule, all 50 cases were likely to “support [the] contention that these shifts would occur.” Dr. Belzer commented that “due to overwhelming evidence, repudiating the notion that modal shift would occur, it is unlikely that random selection

would have yielded much different results;” and he further mentioned that if there is any bias, it is likely to be on the conservative (higher cost) side. Dr. Belzer stated that it appears that EPA “selected these cases systematically in an attempt to fairly represent a cross-section of trips about which the private sector was concerned.”

The other two reviewers suggested that clarifications are necessary for some of the methodology assumptions. Dr. Hull suggested a clarification on whether the rail routes used in the analysis are “heavily traveled trunk-line routes” and whether they involve multiple railroads. He explained that though the shortest routes are appealing, railroads might choose longer, even circuitous routes to preserve the long haul to gain the economies of scale and to not have to share the revenue with another railroad by having to use another railroad for part of the way. Dr. Hull further suggested explaining whether the routes were calculated based on “cost of service” or “value of service” and specifying which components were included or providing a clear definition of the calculation method. In his review report, Dr. Hull described both approaches, and noted that in real life railroads use a “value of service” rather than “cost of service” approach.

Mr. Kruse commented that “the approach of looking at origin/destination pairs that stakeholders thought might be affected was excellent.” He also mentioned that based on historical cargo flows, the “commodities that were chosen were appropriate,” and “the involvement of stakeholders was accurate and meaningful.” The fact that backhauls were considered to be empty, in Mr. Kruse’s opinion, was an assumption on the conservative (higher cost) side. Finally, Mr. Kruse commented, the analysis followed “an appropriate trade-off between accuracy and the level of effort.”

With regard to stone shipments, two reviewers suggested that some additional clarification is needed. Mr. Kruse recommended further studying and providing an explanation as to why some facilities used stone originating at a much longer distance, requiring ship transportation, when stone from local quarries may be available. Dr. Belzer noted that “if the higher cost of fuel causes customers to source their products more nearby, then the products must be close enough substitutes that they should not travel such distances in the first place. In other words, if close substitutes do not shift closer then society must be subsidizing excessive freight transport distance, which would be a bad public policy because the economics of the move would not pay the full cost.” Dr. Belzer also suggested EPA to consider quantitatively validating the otherwise subjective statement about the stone analysis, that “the increase in number of quarries is not substantial compared to the number of quarries already located within this radius” on pages 3-5 and 3-6.

3.4 Appropriateness of Databases and Other Inputs

All three reviewers agreed on the need to explain how certain inputs for the analysis were derived. Some of the key suggestions are presented in this section.

Dr. Belzer commented that datasets appear to be acceptable by both EPA and the industry, and seem as most appropriate for this analysis. Dr. Belzer suggested using an average (or trend) price of marine fuel rather than single year price, because “using the 2007 price has a disadvantage of capturing non-random point in time, rather than a trend.” He also made a similar comment about diesel fuel price for trucks and suggested using a long-term trend price. However, he noted that using a lower price results in a “very conservative” estimate in the analysis.

Dr. Belzer also mentioned that it would be helpful to study a coal-supply route from the paper mill in Green Bay, Wisconsin (mentioned in Chapter 2); he suspected that the transfer cost would not make viable a long part-rail/part-marine route. However, the route through South Chicago might be inexpensive because of volume of cargo handled thus making the ton-mile cost lower for a combined rail/marine route versus an all-rail route.

Dr. Hull sought clarifications on the rate/cost inputs provided for the analysis by Chrisman Dager. He reiterated that it should be stated clearly whether these inputs are in terms of “cost of service” or “value of service.” If the inputs are in terms of cost of service, it should be explicitly noted what components were included and what the source of the information was. If the inputs are in terms of value of service, it should be noted how they were estimated and what the source of the information was.

Mr. Kruse suggested providing a source for the specific engine marine fuel oil consumption, and how the assumed propulsion power was derived. He also suggested the following:

- updating the Great Lakes basin profile with more recent data (if available) in Chapter 2, Appendix A, Table 13;
- stating the sources for following variables: Auxiliary Engine Power, Auxiliary Engine Load Factor in Port, and Rail Energy Intensity in Chapter 2, Appendix A, Table 16;
- justifying the assumption that a vessel would be loaded to 85% of its capacity (this assumption directly affects unit freight costs) in Appendix A;
- verifying the depth of ports located on the Great Lakes (this assumption also directly affects unit freight costs); in Mr. Kruse’s experience, the Corps of Engineers’ Port and Waterway Facilities data are not reliable for an inland waterway system;

- verifying the truck load assumption of 43 short tons, if the quarry is located in the United States; and
- verifying the assumption that the Algoma facility included in the analysis does have the ability to receive iron ore by rail, and providing the source of the assumption that “80% of the delivered iron ore costs, is the iron ore cost at the mine.”

3.5 Data Analysis Conducted

In general, all reviewers agreed that transportation mode shift, source shift, and production shift analyses performed were straightforward, appropriate, and adequate. Dr. Belzer commented that the mode, shift, and production analyses were appropriate. Dr. Hull commented that the analysis was straightforward and particularly the crushed stone analysis was “quite good, though it would still benefit from a review of the underlying data sources.” Dr. Hull commented that the coal analysis could have been more thorough and the steel and supplementary analyses should be revised to incorporate a global perspective.

More specifically, Dr. Hull made the following comments with regard to stone, coal, steel, and supplementary portions of the mode shift analysis:

- *Stone*: Several simplifying assumptions were made and need to be validated. These assumptions include the use of theoretical transportation cost from origin to destination, the assumption that highways were a “straight line,” the fact that Michigan specialty stone replaces local quarry stone ton for ton, and the fact that heavy trucks are allowed on highways.
- *Coal*: The explanation of this portion of the analysis was rather confusing, and could benefit from further explanation in simpler terms.
- *Steel*: Since steel is a vital industry in the Midwest, it can benefit from an expanded analysis. One of the assumptions made in the analysis is that coal supplied to Great Lakes by marine route is used in steel production, while in reality it is almost always used by power plants.
- *Supplementary*: This portion of the analysis is generally compelling, but requires adding grain backhauls and a wider (worldwide) marketplace.

Mr. Kruse thought the analysis was “appropriate and adequate” with the exception of concern why some facilities do not use stone from local quarries (See Section 3.3, above).

3.6 Appropriateness of the Conclusion

In general, the reviewers commented that the conclusions drawn in the EPA Report were appropriate. Dr. Belzer commented that conclusions were adequate based on the information that was analyzed, and that cost increases due to a fuel change would be lost in the noise of price changes and would not cause the shifts in question.

Dr. Hull suggested that EPA expand on the report, commenting that “with the Great Lakes industries on the decline, the study needs to consider the global marketplace and present potential import/export opportunities.” Also, since the EERA model is theoretical, and the assumptions may differ from the actual routes and rates, Dr. Hull encouraged a final validation of the model by gaining stakeholders’ input and perspective about a subset of 16 selected origin/destination routes. Dr. Hull also noted that in reality the railroads and marine operators price their services based on value of service, and even though the analysis shows that no modal shift will occur, the higher priced marine fuel can result in “less business overall, as manufacturers shift production away from the Great Lakes toward lower cost supply sources.”

Mr. Kruse thought the conclusions were appropriate and justified given the data sources and inputs used in the analysis.

3.7 Other Comments

In addition to the comments on the charge questions, the reviewers also provided other suggestions and comments, which are summarized in this section.

Dr. Belzer commented that even though transportation mode shift, source shift, and production shift analyses are of a concern in the EPA Report, from an economic and environmental standpoint “these shifts would be entirely acceptable and in many cases more efficient,” especially considering that the societal benefits in this case exceed costs by anywhere between 30:1 and 100:1. Dr. Belzer suggested that these impacts can be examined through the use of a broad type of macroeconomic model, such as that incorporated in REMI and IMPLAN would be adequate to perform a full cost-benefit analysis. Dr. Belzer also commented that truck and locomotive industries already endure the costs of switching to low-sulfur fuel that resulted from higher fuel prices and restrictions. He argued that actions to preserve air quality should affect all transportation modes. Thus, if maritime sector were not required to comply with cleaner fuel regulations, the society “risks subsidizing marine sector over others, contributing to economic inefficiency and social inequity.”

Dr. Hull urged EPA to include in the analysis the impact of the global marketplace on three commodities in the Great Lakes region:

- *Grain*: Grain from the Midwest is shipped via three main routes: by ship through the Great Lakes/St. Lawrence, by rail to the U.S. West Coast for loading on ships to China, and by river barge down the Mississippi River for export from New Orleans. These routes likely depend on transportation rates, and small rate changes might have major impacts on the choice of route. As stated on p.7-26, almost 70% of grain shipments on the Great Lakes are destined for export, so this might be a commodity that should be analyzed explicitly.
- *Steel Coils*: Break-bulk ships (typically operated by FedNav, Polstream, and Wagenborg) export steel coils from Northern Europe by crossing the Atlantic, transiting the Seaway, and discharging partial cargos at Cleveland, Detroit, and Burns Harbor. These ships are then loaded with grain on the backhaul trip to Europe. Thus, it is important to address whether requiring a use of low-sulfur fuel would: 1) make deliveries of steel coils on their way to the United States through the Seaway less economically attractive, shifting it to East Coast ports for an overland rail/truck route, and potentially causing more emissions from rail/trucks and 2) make backhaul deliveries of grain less available, thus making delivery of steel coils less economically attractive, and causing the routes to shift inland, causing higher emissions from rail/trucks.
- *Containers*: Containerships transit the Seaway as far as Montreal and then are loaded on trucks and rail for delivery, with approximately half of the containers going to Canada and half going to the United States. Currently, plans are underway to extend container deliveries into the Great Lakes by water, directly through Europe or by loading containers on feeder ships or barges in Montreal or Halifax (the ports of Cleveland, Toledo, Erie/Conneaut, and Oswego are the interested ports and Wagenborg, Great Lakes Feeder Lines, and McKeil Marine are the interested carriers). If realized, these plans would lower SO_x, NO_x, and particulate emissions by replacing rail and truck deliveries from Montreal and the East Coast. It is important to study whether requiring use of low-sulfur fuel would make these plans less economically attractive.

Mr. Kruse mentioned that one facet that is missing from the analysis is the concept of equity, i.e. placing low-sulfur fuel requirements on the truck and locomotive industries but not on the marine would represent an indirect subsidy to the marine industry.

Appendix A: Resumes of Selected Reviewers

Resume of Reviewer	Page
1. Dr. Michael Belzer	A1-A2
2. Dr. Bradley Hull	A3-A6
3. Mr. James Kruse	A7-A11

MICHAEL H. BELZER, PhD
Wayne State University
College of Liberal Arts and Sciences
656 W Kirby, 2074 Faculty/Administration Bldg.
Detroit, MI 48202
(313) 577- 3345
michael.h.belzer@wayne.edu

BIOGRAPHICAL SUMMARY:

Michael H. Belzer is Associate Professor in the Department of Economics of the College of Liberal Arts and Sciences at Wayne State University. He also is Associate Director of the Alfred P. Sloan Foundation's Trucking Industry Program, one of more than twenty Sloan Industry Centers. The Trucking Industry Program focuses on trucking industry operations, regulation, industrial organization, and industrial relations, and Dr. Belzer directs its Trucking Industry Benchmarking Program. He serves as Chair of the Transportation Research Board Committee on Trucking Industry Research, as a member of the Freight Systems Executive Board, and as a member of the Committee on Freight Economics and Regulation as well as a member of the Truck and Bus Safety Committee. Additional current interests include labor policy, industrial organization, and the role of transportation in economic development.

DEPARTMENT/COLLEGE:

Department of Economics, College of Liberal Arts and Sciences

Departmental web page: <http://www.clas.wayne.edu/unit-faculty-detail.asp?FacultyID=595>

PRESENT RANK & DATE OF RANK:

Associate Professor, since September 1, 2000.

WSU APPOINTMENT HISTORY:

Year Appointed/Rank: September 1, 2000, as Associate Professor

Tenured in 2004 as Associate Professor of Urban and Labor Studies in the College of Urban, Labor, and Metropolitan Affairs (CULMA)

With closure of CULMA on September 30, 2005, tenure granted in Department of Interdisciplinary Studies, College of Liberal Arts and Sciences

With dissolution of the Department of Interdisciplinary Studies on September 30, 2007, tenure granted in Department of Economics, College of Liberal Arts and Sciences

Academic Director, Master of Arts in Industrial Relations Program
September 1, 2000 – October 15, 2003

EDUCATION:

- Baccalaureate: A.B. College of Arts and Sciences, Cornell University, 1972
- Graduate: M.S. Graduate School, Cornell University, 1990 (Ithaca, NY)
Ph.D. Graduate School, Cornell University, 1993 (Ithaca, NY)
(Studied at New York State School of Industrial and Labor Relations)
- Major: Collective Bargaining, Labor Law, and Labor History
- Minors: City and Regional Planning/ Human Resource Studies/ Research Methods

SELECTED PUBLICATIONS:

Book Chapters:

1. "Labor and Human Resources in the Freight Industry." A chapter in *Intermodal Freight Transportation*, Lester Hoel, Genevieve Giuliano, and Michael Meyer, editors. Publisher: Eno Transportation Foundation, Inc. Forthcoming.
2. "The Next Move: Metropolitan Regions and the Transformation of the Freight Transport and Distribution System." With Susan Christopherson. In *Urban and Regional Policy and Its Effects*, edited by Nancy Pindus, Howard Wial, and Harold Wolman. Brookings Institution Press. 2009.
3. "The Effects of Trucking Firm Financial Performance on Safety Outcomes." With Marta S. Rocha and Daniel A. Rodriguez. In *Transportation Labor Issues and Regulatory Reform*. James H. Peoples and Wayne K. Talley eds. Research in Transportation Economic Series. Rotterdam, The Netherlands: Elsevier Science Publishers, 2004, pp. 35-55.

Peer-Reviewed Journal Articles Published:

1. "Environmental determinants of obesity-associated morbidity risks for truckers." *International Journal of Workplace Health Management*. With Yorghos Apostolopoulos, Sevil Sönmez, and Mona M Shattell, In press.
2. "Worksite-Induced Morbidities Among Truck Drivers in North America: A Comprehensive Literature Review." With Yorghos Apostolopoulos, Sevil Sönmez, and Mona M. Shattell. *American Association of Occupational Health Nurses [AAOHN] Journal*. Vol. 58, No. 7, 2010: pp. 285-96.
3. "Empirical Evidence of Toll Road Traffic Diversion and Implications for Highway Infrastructure Privatization." With Peter F. Swan. *Public Works Management & Policy*, Vol.14, No. 4 (April 2010): pp 351-73.

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LOGISTICS MANAGEMENT EXPERT with well-developed management skills and proven ability to control costs, maximize service levels and build profitable national and international logistics operations.

- Recognized as a leader in oil/chemical industry logistics and strategic planning issues.
- Creative problem solver, known for ability to creatively overcome obstacles and develop innovative solutions for difficult logistics problems.
- Highly effective in utilizing logistics to enhance marketability of company assets.
- Broad base of industry contacts and an up-to-date knowledge of market conditions.

Core Competencies:

Supply Chain Management	Operations Management	Operations Planning
Distribution Management	Operations Research	Carrier Selection / Negotiation
Emergency /Haz-Mat Response	Fleet Management	Total Quality Management
Inventory Management	Customer Service	Warehouse Management

BIOGRAPHICAL SUMMARY

1. Previously employed by British Petroleum for 28 years in a wide variety of logistics and supply chain positions. In these positions I stored and delivered chemicals, petroleum, and petroleum products, both domestically and internationally by rail, truck, barge, pipe, and ship.
2. For the past 11 years I have been a professor at John Carroll University where I research transportation topics and teach courses in logistics and operations management. More recently, I also worked on a part-time basis for the Port of Cleveland developing new business. In addition, I was hired by NEOTEC (Northeast Ohio Trade and Economic Consortium) to perform the "Northeast Ohio Logistics Infrastructure Study" which can be found at www.neohiotransportationupdate.com or www.neotec.org.
3. I hosted three seminars on campus in the past year. Each was attended by more than 250 business people. The first was titled "The Great Lakes/St Lawrence Marine Highway, Fitting the Pieces Together," and the second was titled "Northeast Ohio Logistics Infrastructure." The recent August 30th seminar is the second annual "Fitting the Pieces Together" seminar. These seminars have led directly to decisions to 1) expand rail access to the Port of Cleveland, 2) reexamine the feasibility of a cross lake ferry, and 3) reexamine the feasibility of a Cleveland/Montreal scheduled waterborne service.
4. Through my efforts, John Carroll University has been accepted a member of the Great Lakes Maritime Research Institute and the Great Lakes Coalition.

Professional Profile

Education

University of Pennsylvania, BS in Mathematics
Stanford University, MS in Operations Research
Case Western Reserve University, PhD in Operations Research

Experience

JOHN CARROLL UNIVERSITY - Cleveland, Ohio

Associate Professor of Management (2007-present)

Teach undergraduate and MBA courses in Logistics, Transportation, Operations Management, MIS

Assistant Professor of Management Information Systems (1999-2007)

Teach undergraduate and MBA courses in MIS, ERP Systems, Operations Management, and Logistics

BP OIL COMPANY - Cleveland, Ohio

Logistics Expert (1997-1999)

Functioned as logistics expert, supporting operations such as Refinery Supply, Alaskan Trading, International Oil Trading, Exploration, Terminals and Chemicals. Develop flexible, cost-effective distribution channels for BP's business units.

- Developed new crude oil and finished product supply routes, when BP sold one refinery and greatly modified another. Logistics expenditures exceed \$150,000,000 per year.
- Persuaded BP to spend \$1million to improve a terminal, resulting in \$2million/year savings, and a partnering offer, due to its newfound logistics potential. *Completed similar projects at other terminals.*
- Identified and resolved a persistent crude oil contamination problem. \$2 million annual savings.
- Avoided a "last minute" sale of \$9 million worth of crude oil (in transit to one of our refineries during a fire). Identified unique method of supplying the burned refinery with intermediate feedstocks.
- Published monthly "*Pipeline News*" newsletter for three years.
- Provided consulting services to the Canadian government.

Alaskan Oil Logistics Mgr. – Lower 48 and Panama (1988-1997)

Managed \$100,000,000-\$300,000,000 in annual logistics expenditures. Managed the flow of Alaskan Oil to mid-continent markets along a 12,000 mile long supply chain (via crude oil tanker deliveries through Panama and four cross country pipeline networks). Responsibilities included: tanker and pipeline scheduling, inventory management, customer service, new account development, and quality control. Managed BP's operations at four crude oil terminals.

- Increased customer base by 25%, cut inventories by 25%, and cut transportation costs by 20%.
- Customer deliveries 99% on time and within specification.
- Developed 10-15 new customers for Alaskan crude in the mid-continent.
- Extended our marketing area by utilizing unique modes of transportation.
- Successfully avoided many “last minute” sales of crude oil, during multiple logistics disruptions
- Increased BP’s market share by helping competitors find low cost routes to other markets.

BP OIL COMPANY AND BP PIPE LINE COMPANY - Cleveland, Ohio

Logistics Consultant / Mgr. Computer Resources (1986-1988)

Provided logistics consulting services; developed multiple crude supply routes for BP’s five refineries.

- Resolved a 10-year raw materials bottleneck at BP’s New Orleans refinery.
- Developed access routes from BP’s Los Angeles supply hub to four independent LA refiners.
- Developed the *first* use of laptop computers for pipelines (software was sold to Exxon).

BP CHEMICALS - Lima and Cleveland, Ohio

Director of Logistics (1978-1985)

Managed \$100,000,000 in annual logistics expenditures. Coordinated the distribution of 20 product lines. Assumed responsibility for planning and day-to-day operations (i.e., transportation, storage, fleet management, private trucking, emergency response, export and hazardous materials regulation). Utilized multiple transportation modes, including rail, truck, barge, pipeline and ship. Directed activities of more than 100 trucking companies, a fleet of 1000 rail cars, 15 tractor-trailers, and 30 storage facilities.

- Supervised and directed a staff of 30, and managed a \$12,000,000 budget.
- Coordinated daily shipping operations (from order entry through physical delivery), and achieved a 99% on-time performance; additionally responsible for emergency response to hazardous situations.
- Managed a 1000 rail car fleet in the U.S. and a 30-car rail fleet in Europe.
- Planned and negotiated rates and service commitments with tank car suppliers, railroads, trucking companies, barge lines and ocean carriers.
- Negotiated warehousing facilities for chemicals in the U.S. and Europe.
- Successfully implemented logistics innovations that improved system performance.

SOHIO - Cleveland, Ohio

Management Science Specialist (1973-1977)

Developed linear programs and computer simulations for a wide variety of logistics issues critical to the company’s growth and success. Served as member of six-person team (\$500,000,000 project) that selected a crude oil tanker fleet, developed supertanker

port, and identified market for Alaskan oil following development of the Alaskan oil field.

OTHER EXPERIENCE (1986-1999)

Lecturer - John Carroll and other local Universities. Teach evening MBA courses in Operations Research and Operations Management (part-time)

Selected Publications

Hull, B., "Supply Chain Mythology", submitted to the Decision Sciences Journal

Hull, B., "Northeast Ohio Logistics Infrastructure Study." Sponsored by NEOTEC, January 2010, www.neohiotransportationupdate.com.

Hull, B., "Frankincense and Myrrh – the Oldest Global Supply Chain?" *Journal of Macromarketing*, Vol. 28, No. 3, 2008, pp. 275-289.

Hull, B., "Have Supply (Driven) Chains Been Forgotten?," *International Journal of Logistics Management*, 16.2 (2005): 218-36.

Hull, B., "Oil Pipeline Markets and Operations," *Journal of the Transportation Research Forum*, 44.2 (2005): 111-25. [2] (Fall Issue).

Hull, B., "The Role of Elasticity in Supply Chain Performance", *International Journal of Production Economics*, Vol. 98, Issue 3, Dec. 2005, pp. 301-314

Grenci, R. and B. Hull, "New Dog, Old Tricks: ERP and the Systems Development Life Cycle", *Journal of Information Systems Education*, Vol. 15, No. 3, (Fall 2004), pp. 277-287.

Hull, B. "A Structure for Supply Chain Information Flows and its Application to the Alaskan Crude Oil Supply Chain", *Logistics Information Management*, 15,1,2002.

Ten editions of *Pipeline News*, a pipeline industry newsletter, which I wrote and distributed to 100+ colleagues and customers.

Hull, B., "How to Make a Logistics Partnership Work", *Transportation and Distribution*, June 1989.

Hull, B., TE Moroni, DL West, "Automating Liquid Line Shipping Documentation." *Pipeline Industry*, May 1987.

Hull, B., TE Moroni, GE Shetler, DL West, "Automating Flow of Pipeline Shipments Documentation," *Proceedings of the American Petroleum Institute Conference*, April 1986.

Hull, B., TE Moroni, DL West, "Adapting Small Computers to Pipelines," *PipelineDigest*, October 1986.

Hull, B., "Two Algorithms for Matroids", *Discrete Mathematics*, Vol. 13, No 2, October 1975.

C. JAMES KRUSE
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BIOGRAPHICAL SUMMARY

Mr. Kruse is the Director of the Center for Ports and Waterways at the Texas Transportation Institute (TTI). He is responsible for identifying research and extension needs in the port community and mobilizing resources to meet those needs.

He served in a senior executive capacity for nine years at the Port of Brownsville (1988-1997), Texas (eight years as port director), where he led a successful effort to acquire a Presidential Permit for an international bridge. Following his service at the Port of Brownsville, Mr. Kruse worked as a Regional Program Manager for Foster Wheeler Environmental's Ports Harbors & Waterways Program and assisted on port-related projects around the country.

Mr. Kruse has acquired a strong transportation planning background, having served on numerous local, state, and national boards and task forces. He was an active participant in the development of long range plans for a seaport and airport in South Texas, he has worked on statewide issues in Texas, he has participated in border transportation organizations, and he has assisted ports from Corpus Christi to New York with planning and environmental issues. Mr. Kruse is bilingual (Spanish/English) and has worked on a number of projects in the Latin American region.

EDUCATION

MS, International Business and Human Resources, Houston Baptist University, 2000.

MBA, Accounting and Finance, University of Kansas, 1977.

B.A., Business Administration, Mid-America Nazarene University, 1975.

RELEVANT EXPERIENCE

Texas Transportation Institute, Center for Ports & Waterways (2002 – Present). Director, Center for Ports and Waterways

As Director of the Center for Ports & Waterways, primary focus is on acquiring research contracts for the organization and directing that research.

- Technical Analyst: Provided technical assistance to Puerto Rico Sea Grant Program in evaluating issues raised by the Environmental Impact Statement for the proposed Port of the Americas
- Technical Analyst: Prepared comments for Port of Chicago regarding land use options
- Organizer: Organized the 2004, 2006, and 2008 Texas Ports and Waterways Conference co-hosted by Sea Grant and the Center for Ports and Waterways

- Research Analyst: Gathered information on Liquefied Natural Gas import terminals and presented to Sea Grant agents and state legislators from various states
- Investigator: *Panama Canal Dry-Bulk Market Segment Peer Review* (Research funded by Panama Canal Authority, 2003)
- Principal Investigator: *Analysis of Start-up Cross-Gulf Shipping Activities with Mexico Since 1990: Problems and Opportunities* (Research funded by Southwest Region University Transportation Center, 2004)
- Principal Investigator: *Effect of Security Requirements on Port Infrastructure Development and Funding* (Research funded by Southwest Region University Transportation Center, 2005)
- Principal Investigator: *Analysis Of U.S.-Mexico Border Trade Targets For Short Sea Shipping* (Research funded by Gulf Ports Association of the Americas, 2006)
- Principal Investigator: *Container on Barge Market Analysis – Task 1* (Research funded by private industry, 2006)
- Principal Investigator: *Environmental Impacts of Modal Transportation Study-Phase I*, (Research funded by Maritime Administration, 2006)
- Principal Investigator: *The Value of Texas Seaports in an Environment of Increasing Global Trade (Research funded by Texas Department of Transportation)* – (Research funded by Texas Department of Transportation, 2007)
- Principal Investigator: *A Modal Comparison of Domestic Freight Transportation Effects on the General Public* (Research funded by US Maritime Administration and National Waterways Foundation, 2007)
- Principal Investigator: *Short Sea Shipping Initiatives and the Impacts on the Texas Transportation System* (Research funded by Texas Department of Transportation, 2007)
- Investigator: *Study for the Development of a National Competitiveness Pact* (Research funded by Secretariat of Communications and Transportation, Mexico, 2008)
- Principal Investigator: *An Analysis of Harbor Master Positions in Cargo Ports* (Research funded by Port of Houston Authority, 2008)
- Principal Investigator: *Lock And Dam Non-Navigation Beneficiary Study* (Research funded by National Waterways Foundation, 2008)
- Principal Investigator: *Development of Potential Policies and Incentives to Encourage Movement of Containerized Freight on Texas Inland Waterways* (Research funded by Texas Department of Transportation, 2008)
- Investigator: *Emerging Trade Corridors and Texas Transportation Planning* (Research funded by Texas Department of Transportation, 2009)
- Investigator: *Protecting Waterways from Encroachment* (Research funded by Texas Department of Transportation, 2010)
- Principal Investigator: *North American Marine Highway Operations* (Research funded by National Cooperative Freight Research Program, Transportation Research Board, 2010)
- Principal Investigator: *Transportation Rate Analysis For The Gulf Intracoastal Waterway – West* (Research funded by the US Army Corps of Engineers, 2010)
- Principal Investigator: *Modal Comparison of Greenhouse Gas Emissions* (Research funded by the National Waterways Foundation, 2009)
- Principal Investigator: *Metropolitan Planning Organization (MPO) Maritime Information Needs Study*, (Research funded by Marine Highways Cooperative Program, 2010)

- Principal Investigator: *Analysis of the Effects of Lack of Channel Maintenance Dredging* (Research funded by Port of Houston Authority , 2010)
- Principal Investigator: *Update to “A Modal Comparison of Domestic Freight Transportation Effects on the General Public”* (Research funded by National Waterways Foundation—Research in Progress)
- Principal Investigator: *Transportation Rates & Closure Response Research - Calcasieu Lock* (Research funded the U.S. Army Corps of Engineers—Research in Progress)
- Active Memberships:
 1. Transportation Research Board Committee on Ports and Channels
 2. Transportation Research Board Committee on Marine Environment
 3. Transportation Research Board Committee on Inland Waterways
 4. Harbors, Navigation and Environment Committee, American Association of Port Authorities
 5. Texas Ports Association
 6. Houston-Galveston Area Maritime Security Committee

Foster Wheeler Environmental Corporation, (1997–2002). Regional Program Manager, Ports, Harbors & Waterways Program

Project Manager- *Gulf Intracoastal Canal Association, Verification Analysis of Economic Impact of Lower Laguna Madre Reach of GIWW, 2002.*

Project Manager- *BP Refinery (Amoco Oil) Navigation Project Permit and Development Assistance (Texas City), 2001-2002.*

- Business Development Lead & Project Team Member- *Maine Department of Transportation Dredging Management Action Plan, 2001.*
- Project Manager- *Port of Texas City Disposal Area Management Plan, Phase II, 2001.*
- Task Manager- *Port Authority of New York & New Jersey, Analysis of Opportunities and Issues for Nearshore Fills for Terminal Expansion, 2000.*
- Project Manager- *Port of Houston Authority, Administrative and Oversight Assistance with Alexander Island Spill Cleanup, 1999-2000.*
- Project Manager- *Port of Texas City Disposal Area Management Plan, Phase I, 1999.*
- Project Manager- *Port of Corpus Christi, Assumption of Maintenance Analysis, Rincon Canal System, 1998.*
- Project Manager- *Port of Pascagoula (MS), Project Management for Dredging and Infrastructure Improvements, 1997-1999.*

In addition to his project activities, Mr. Kruse was the regional Business Development Manager for Ports, Harbors, & Waterways opportunities, and assisted on many proposals both nationwide and in foreign countries.

Port of Brownsville, TX, (1988 – 1997). General Manager & Port Director

As Port Director, served in a wide variety of functional areas:

- Was appointed by Gov. Ann Richards to Texas/Mexico Authority
- Supervised planning, design, and implementation of \$100 million in improvements to the Port facilities

- Engaged in extensive public relations efforts including newspapers, radio, TV, magazines, seminars, speaking engagements, and special campaigns
- Re-evaluated and redesigned organizational structure, producing new job descriptions, procedures, and policies
- Wrote the Port's long range plan
- Worked extensively with business leaders and State and Federal Government officials in U.S. and Mexico on legislative and economic development matters

Major project activities included:

- Project Manager- *Permitting and Project Development for New International Bridge Crossing between Brownsville, TX and Matamoros, Tamaulipas, Mexico*, 1990-1997.
- Project Coordinator- *Channel Deepening Project, Brownsville, TX*, 1989-1995.
- Project Coordinator- *Mexico Intracoastal Waterway, Analysis and Relations with Mexican Government*, 1993-1997.
- Project Manager- *Acquisition and Installation of Drydock for Port of Brownsville, TX*, 1994-1996.
- Project Oversight- Provided project oversight for railroad relocation, new dock construction, and rehabilitation and reconstruction of docks and roads for the shrimping industry.
- Legislative: Testified before a number of U.S. Congressional Committees and Texas legislative committees on a variety of issues.

During tenure at Port of Brownsville, served on the following Boards/Committees:

- Texas Border Transportation Technical Advisory Committee (TxDOT)
- Economic Development Subcommittee of the Statewide Transportation Plan Committee for development of the 1994 Texas Transportation Plan (Texas Department of Transportation)
- American Association of Port Authorities, Board of Directors
- Gulf Ports Association of the Americas
- Long Range Plan Committee for Brownsville/South Padre Island International Airport
- Long Range Plan Committee for Brownsville Navigation District

Arthur Andersen & Co., (1977-1980), Senior Analyst, Management Information Consulting Division

Designed, installed, and revised several accounting systems for use in oil and gas industry in Texas and Mexico. Worked one and one-half years in Mexico City (1978-1980) on project for Petroleos Mexicanos (PEMEX).

SELECTED PUBLICATIONS

J. Mileski, R. Thrailkill, K. Haupt, J.J. Lane, W.T. McMullen, J. Gunn, C.J. Kruse, D.H. Bierling, L.E. Olson, J. Huang, P.-. Lorente. *Protecting Waterways from Encroachment*. 0-6225-S. Texas Transportation Institute, College Station, TX. 2010.

J. Mileski, W.T. McMullen, R. Thrailkill, J. Gunn, K. Haupt, C.J. Kruse, J.J. Lane, D.H. Bierling. *Recommendations and Guidelines on Shoreline Development and Hazards to Navigation*. 0-6225-P1. Texas Transportation Institute, College Station, TX. December 2010.

J. Mileski, R. Thrailkill, K. Haupt, J.J. Lane, W.T. McMullen, J. Gunn, C.J. Kruse, D.H. Bierling, L.E. Olson, J. Huang, P.-. Lorente. Analysis and Recommendations on Protecting Waterways from Encroachment. 0-6225-1. Texas Transportation Institute, College Station, TX. August 2010.

C.J. Kruse, C.A. Morgan, N. Hutson. Potential Policies and Incentives to Encourage Movement of Containerized Freight on Texas Inland Waterways. 0-5937-1. Texas Transportation Institute, College Station, TX. March 2009.

C.J. Kruse, N. Hutson, C.A. Morgan. Guidebook: Potential Policies and Incentives to Encourage Movement of Containerized Freight on Texas Waterways. 0-5937-P1. Texas Transportation Institute, College Station, TX. February 2009.

C.J. Kruse, J.C. Villa, D.H. Bierling, M.S. Terra, N. Hutson. Short Sea Shipping Initiatives and the Impacts on the Texas Transportation System. PSR. 0-5695-S. Texas Transportation Institute, College Station, TX. 2007.

C.J. Kruse, J.C. Villa, D.H. Bierling, M.S. Terra, N. Hutson. Short Sea Shipping Initiatives and the Impacts on the Texas Transportation System: Technical Report. SWUTC. 0-5695-1. Southwest Region University Transportation Center, Texas Transportation Institute. December 2007.

C.J. Kruse, A.A. Protopapa, L.E. Olson, D.H. Bierling. A Modal Comparison of Domestic Freight Transportation Effects on General Public: Final Report. TTI-2007-5. Texas Transportation Institute, College Station, TX. December 2007.

C.J. Kruse, J.C. Villa, D.H. Bierling, J.M. Solari-Terra, P.-. Lorente. Container on Barge Market Analysis - Task 1. April 2006.

Appendix B: Charge Questions

Particulars	Page
1. Letter to the reviewers with charge questions	B1-B2

TO: Michael H. Belzer, PhD (Wayne State University)
Bradley Hull, PhD (John Carroll University)
James Kruse (Texas A&M University)

FROM: Alex V. Rogozhin (RTI)

CC: Dileep K. Birur (RTI); Michael P. Gallaher (RTI); Lauren Steele (EPA)

DATE: December 1, 2010

SUBJECT: Charge Questions for Peer Review of Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping.

Thank you for agreeing to review the enclosed report, “Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping.”

EPA’s Office of Transportation and Air Quality recently finalized regulations addressing emissions from Category 3 marine diesel engines and their fuels (the C3 Marine Rule, 83 FR 22896, April 30, 2010). This rule contains EPA’s coordinated strategy to address these emissions through a combination of national and international actions. As EPA developed the C3 Marine Rule, stakeholders from the Great Lakes shipping industry expressed their concerns that the proposed program, particularly the fuel sulfur limits, would lead to higher operating costs for ships operating on the Great Lakes. They indicated that this would lead to a transportation mode shift away from ships and toward trucks or rail, which could increase emissions overall by moving to less efficient ground transportation. They also indicated that the increased operating costs could affect the market for crushed stone, leading users to change their source from stone transported from the upper Great Lakes to local quarries. In addition, there was concern about a possible production shift for steel manufacturing and electricity generation, which would also adversely affect the Great Lakes shipping sector. Although EPA did not change its final rule with regard to applying the engine standards and fuel sulfur limits to the Great Lakes, EPA included several provisions to address these concerns and indicated that it would perform an economic impact analysis of the rule on Great Lakes shipping. The attached report contains that analysis. We are submitting this document to you for a peer review of the methodology, and the validity of the data and assumptions that go into it.

EPA has provided direction and charge questions for this review and these are included below. A teleconference call will also be arranged so that EPA can respond to questions from individual reviewers on the material that was provided for review. The completed review reports are to be furnished to RTI by January 12, 2011.

Elements to be addressed in the Charge to the Reviewers of the Report on “Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping.”

The report looks at three aspects of EPA’s recent Category 3 marine rule raised by stakeholders with respect to the application of stringent fuel sulfur limits to ships that operate on the Great Lakes. Specifically, the report examines whether higher fuel costs associated with switching from heavy-fuel oil to distillate fuel will result in transportation mode shift, source shift, or production shift.

Three separate methodologies are used for the analyses. The transportation mode shift was performed by ICF Int'l. with EERA, and uses a route-based approach. The source shift analysis was performed by EPA and uses a competitive radius approach. Finally, the production shift was performed by EPA and uses a retail revenue approach.

The report also contains information on EPA's estimated emission inventories (Chapter 4), air quality impacts and human health and welfare benefits (Chapter 5), costs (Chapter 6), and industry characterization (Chapter 7). However, these chapters are included in the report for information purposes only and we are not asking you to review them.

We request that your review primarily focus on: 1) clarity of the presentation, 2) the overall approach and methodology, 3) appropriateness of the datasets and other inputs, 4) the data analyses conducted, and 5) appropriateness of the conclusions. For this review, no independent data analysis is required, nor is it required that you duplicate the results. The appendices to several chapters of the report contain detailed information about the analysis, including contractor reports where relevant. You may need to review and comment on these appendices as part of the peer review of the report, especially Appendix 2A, which is the final project report from EERA and ICF.

In your comments, you should distinguish between recommendations for clearly defined improvements that can be readily made based on data reasonably available to EPA, versus improvements that are more exploratory or dependent on data not available to EPA. The comments should be sufficiently detailed to allow a thorough understanding by EPA or other parties familiar with the work.

Your comments should be provided as an enclosure to a cover letter that clearly states your name, the name and address of your organization, what material was reviewed, a summary of your expertise and qualifications, and a statement that you have no real or perceived conflicts of interest. Please also enclose an email with your comments in MS Word, or a format that can be imported into MS Word. The comments should be sent in care of Alex Rogozhin to the E-mail: avr@rti.org.

This study is in response to an EPA rulemaking on this subject. Therefore, EPA will make the report and your comments available in the Public Docket for the rule.

We would appreciate your not providing the peer review materials or your comments to anyone else until EPA makes them public. We would also like to receive the results of this review in the shortest time frame possible, preferably within four weeks of your receipt of this request. If you have any questions about what is required in order to complete this review, or if you find you need additional background material, please contact Alex Rogozhin by phone (919-541-6335) or e-mail [avr@rti.org]. If you have any questions about the EPA peer review process itself, please direct them to Ms. Ruth Schenk of EPA by phone (734-214-4017) or e-mail [schenk.ruth@epa.gov]

You will be paid a flat fee of \$5,000 for this peer review. This fee was calculated based on an estimated 50 hours of review time at a rate of \$100 per hour. In your cover letter please indicate the number of hours spent on the review; spending fewer or more hours than our estimate will not affect the fee paid for this work, but will help us improve our future budget estimates.

Appendix C: Questions and Answers Provided During the Review Process

Particulars	Page
1. Questions provided by reviewers for conference call #1	C1-C3
2. Log of questions and answers during conference call # 2	C4-C6

Conference Call # 1:

Reviewers provided EPA with a list of questions that directed EPA's presentation, and were addressed on the conference call. Reviewers were given an opportunity to ask additional questions during the conference call.

Participants:

Reviewers: Michael H. Belzer, PhD (Wayne State University); Bradley Hull, PhD (John Carroll University); James Kruse (Texas A&M University)
EPA: Lauren Steele, Jean-Marie Revelt
RTI: Alex Rogozhin

Questions from Dr. Brad Hull

General Questions:

1. In the Great Lakes area, what percent of the emissions are caused by ships? I ask this because, being a depressed economy, there doesn't seem to be much Great Lakes shipping.
2. Please confirm that the EPA C3 requirements are the same as those stated in the last paragraph on page 12 of the executive summary. Why didn't EPA make its ruling directly rather than through an amendment to MARPOL Annex VI?
3. How do the MARPOL Annex VI limits compare with those proposed for the North American ECA? Are they more stringent for the Great Lakes?
4. Canada must have emissions limits for Canadian Flag vessels. How do their limits compare with the existing US requirements and proposed EPA C3 requirements?
5. Does the technology presently exist to achieve these proposed standards?
6. Could I read some of the stakeholder comments, such as Lake Carriers and Canadian Shipowners? I would like to understand their viewpoint as I review the EPA study.
7. The foreign flag shipping industry does not have an organization like Lake Carriers or Canadian Shipowners. How will the C3 requirements impact international movements of foreign flag ships?

Comparison of the Great Lakes versus other US waterways:

1. How do the EPA C3 requirements compare with those required on the Mississippi/Illinois/Ohio river system? Do the vessels on those rivers utilize C2 or C3 engines?
2. Are the same EPA C3 requirements being applied to domestic US Flag shipping requirements on the East, West, and Gulf Coasts of the US?

Who uses C3 engines? :

My understanding is that the Great Lakes freighters that stay within the Great Lakes operate with C3 engines.

1. Do Great Lakes barge operators use C3 engines – or do they use C2?
2. Do Great Lakes towing companies use C3 engines – or do they use C2?
3. Do the cross-lake ferries use C3 engines? (I assume that Badger does, but is it the only one?)
4. Do oceangoing vessels that transit the Seaway/Great Lakes have C3 engines – or do they use C2? Here I am referring to Seawaymax or smaller vessels that carry steel slabs and coils from Europe to the Great Lakes, grain ships, and breakbulk ships that move project cargo.

Understanding the EPA C3 requirements from a vessel perspective:

1. Do the EPA C3 requirements apply only to US Flag ships? Do Canadian and foreign flag vessels fall under these requirements?
2. Will the EPA C3 requirements be enforced on Canadian and/or foreign flag ships in US Great Lakes waters or US Great Lakes ports?
3. Are the EPA C3 requirements more or less stringent than Canadian requirements? What are the Canadian requirements?
4. The Canadian Shipowners Association is listed as a stakeholder. Why is this, if the EPA ruling only pertains to US Flag ships? What is the expected impact on Canadian ship-owners?

Economic Arguments:

1. What is the expected percentage wise increase that C3 requirements will add to shipping costs?
2. The executive summary concludes that reducing C3 emissions should not impact volumes moving on the Great Lakes, and should not displace them to rail or truck (which would cause more emissions). However, by paying higher fuel costs will the crushed stone (and the other Great Lakes products) less profitable the increased fuel costs to their customers. That is, in economic terms, how much will demand for Great Lakes products be reduced when the fuel price increases? Is this a major or minor point?
My understanding is that for commodities like crushed stone, potash, etc, that transportation costs are a significant percentage of the sales price. In particular, years ago, when I used to move potash from Saskatchewan to the Midwest by rail, that the rail rates were 40% of the sales price of the potash! If this is the case with crushed stone, coal, and the other Great Lakes commodities, might not this phenomenon reduce the overall demand for the product?
3. Could the new C3 standards result in a shift to Canadian sources for crushed stone or coal? After all, US shipping prices would increase relative to Canadian?
4. Any impact on steel movements? Or other breakbulk movements?

5. Why does the list of 16 at risk moves include some cross-lake movements. (Cross-lake movements can utilize foreign flag ships). Might not a cross-lake movement presently being made by a US Flag ship, switch to a Canadian flag ship?

Questions from Mr. James Kruse

General Questions:

1. Does an analysis of the economic dampening effect of an increase in cost without an increase in productivity or service levels need to be performed?
2. A parallel question: There may not be a mode shift, but will businesses continue to consume the same amount of product if the cost rises? In other words, instead of a shift, what if there is a reduction in economic activity?
3. How were individual vessel fuel consumption patterns determined?
4. Chapter 6 seems to indicate that we are only talking about modifying 12 ships. Is that correct?

Conference Call # 2:

Log of January 7, 2011 telephone conversation between RTI (Alex Rogozhin), EPA (Lauren Steele, Jean-Marie Revelt), and Dr. Bradley Hull

- 1) Q: Are steamships excluded? Do they run on heavy fuel? Can they run on residual fuel? Are there any that run on coal?

A: Steamships are exempt from ECA fuel sulfur requirements on the Great Lakes. There are no freighters with steam power from coal operating on the Great Lakes.¹ Steamships on the Great Lakes do run on heavy fuel (aka residual). Steamships were exempted from the ECA fuel requirements after the industry raised safety concerns that may arise from the use of distillate fuel in these boilers, which were designed to use residual fuel.

- 2) Q: Are steamships used on the same trade routes on Great Lakes as diesel ships?

A: Yes, steamships operate on the same trade routes on the Great Lakes as diesel ships.

- 3) Q: Are steamships more expensive to operate on Great Lakes?

A: EPA did not attempt to study the operating costs of steamships operating on the Great Lakes because they are exempt from the ECA fuel sulfur requirements on the Great Lakes.

- 4) Q: Are C2/C3 diesel ships required to comply with regulation if retrofitted, are steamships required to comply if retrofitted?

A: EPA does not require any vessel, including steamships, to be repowered. However, if an owner decides to repower a steamship, the replacement diesel engines would be required to comply with EPA's replacement engine requirements (have to meet current tier standards or demonstrate why this is not possible).

- 5) Q: Are steamships exempt from ECA sulfur requirements until 2015 (or 2014) or indefinitely?

A: Existing steamships that operate on the Great Lakes are exempt from the ECA fuel sulfur requirements indefinitely.

- 6) Q: I recall seeing different numbers of US flagged ships mentioned in the report (some parts 8, some parts 12), what is the correct number of US flagged ships operating in Great Lakes?

¹ It was not mentioned on the Jan 7 call but there is a steam-powered car ferry that burns coal, the S.S. Badger, operating on the Lakes.

A: To our understanding, the correct number is 12. Different parts of the report were written by different authors and contractors, and some might have reviewed outdated literature. Please flag the discrepancies if you see them.

7) Q: Did the study considered US flagged vessels only?

A: The Study was meant to be “flag neutral,” in that the analysis looks at the impact of an increase in fuel costs for a type of vessel operating on a particular route. The flag of the ship was not taken into consideration. The ECA fuel sulfur requirements are expected to have similar impacts on similar vessels regardless of flag. Canadian flagship operators were a part of EPA’s outreach process to stakeholders.

8) Q: Study only considers sulfur standards, the NO_x standards would be affected by retrofitting, correct?

A: Yes, the study considers only the impacts of the ECA fuel requirements on the Great Lakes. The study does not consider the ECA NO_x requirements because new ships are added to the Great Lakes fleet only rarely.

9) Q: What is meant by “BAU” on page 1-12 of the report.

A: BAU stands for “Business as Usual.”

10) Q: Sulfur limits are only supposed to be imposed in US waters (NA ECA), are some of Canadian waters considered NA ECA?

A: NA ECA are defined in an amendment to ANNEX VI, which defines the outer limit of the area. In the C3 rule, EPA clarified that the ECA applies to US internal waters, including waters adjacent or emptying into the ECA and the U.S. portion of the Great Lakes. EPA’s study assumes vessels use ECA fuel on the entirety of the Great Lakes. However, it is up to the Canadian Government to determine how the ECA requirements will apply on their side of the Great Lakes.

11) Q: In what part of Chapter 2 does EPA identify stakeholders?

A: Stakeholders are identified in an Appendix to Chapter 2. EPA invited a wide group of stakeholders to a workshop on the Great Lakes study, consisting of all those individuals and groups that were on EPA’s public outreach list from the Category 3 marine diesel engine rule, the loco/marine rule, and other marine-related actions. Only a small subset of that invitational list participated in the workshop, however. Nevertheless, the main marine trade associations participated, as well as many ship owners and purchasers of marine transportation services. EPA will provide Appendix 2B and the workshop attendee list to RTI for sharing with the peer reviewers.

12) Q: How was the rail-route chosen in a GIFT model?

A: Rail-route was chosen based on shortest distance between the origin and destination points.

13) Q: How were the GIFT model input costs (such as freight rates) calculated?

A: Key inputs, such as freight rates, transfer costs and port conditions, were obtained by contractors who performed the analysis, Corbett and Winebrake, from Chrisman Dager, a transportation expert consulted during the study. Fuel prices were EPA-specified.

14) Q: How were the routes for Great Lakes study developed?

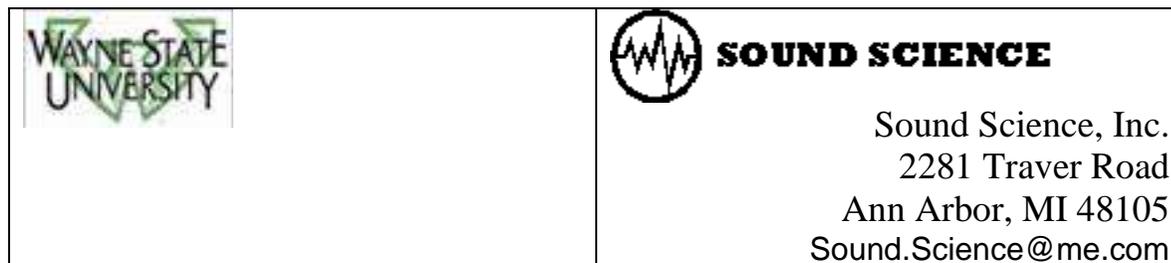
A: The selection of baseline routes is described in Section 2.4 of the Study. Stakeholders identified origin/destination pairs for at-risk routes. EPA selected 16 O/D pairs and provided additional details with respect to actual sites. After sharing this final list with stakeholders, EPA provided this list to the Contractor, who developed the exact routes using the GIFT model, by maximizing the use of the Great Lakes over the route. The alternative all-rail route was determined by minimizing the distance between the origin and destination. Corbett and Winebrake performed due diligence, such as making sure that rails exist and operational for the routes identified for rail transportation scenarios.

15) Q: There is a route, originating in Europe, shipping steel coils, which are later dropped off at Cleveland and Detroit. The ships then get loaded with grain, and head back to Europe. The shipping is done by FedNav located in Canada. This route can be alternated by shipping cargo to NYC, and then distributing to mainland by rail. Is there a specific reason this route is not added?

A: No, this route was not identified to EPA by the stakeholders through the process described above in Q14 and Section 2.4. The reviewer should feel free to add this to his comments.

Appendix D: Cover Letters

Particulars	Page
1. Cover letter from Dr. Michael Belzer	D1
2. Cover letter from Dr. Bradley Hull	D2
3. Cover letter from Mr. James Kruse	D3



Lauren Steele
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105

January 12, 2011

Greetings:

The documents that I received from EPA (or RTI International) were a letter containing the charge questions and the study report by ICF International and Energy and Environmental Research Associates, LLC.

I reviewed all of the documents that I received in developing my expert opinion as contained in the “Peer Review, *Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping*” submitted on December 1, 2010.

I have provided a brief bio along with this report, as requested in the Charge Letter.

I declare that there are no real or perceived conflicts of interest concerning my involvement in this review for the U.S. Environmental Protection Agency.

I have worked approximately 50 hours on this report.

Best regards,

Reviewer Michael H. Belzer

Bradley Z Hull PhD
Associate Professor and Reid Chair
Department of Management, Marketing, and Logistics
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Peer Review of **“ECONOMIC IMPACTS OF THE CATEGORY 3 MARINE RULE ON GREAT LAKES SHIPPING,”** Assessment and Standards Division, Office of Transportation and Air Quality, US Environmental Protection Agency

Bradley Hull’s background for this peer review process:

1. Professor at John Carroll University for the past 12 years, teaching/researching logistics and supply chain courses/issues.
2. University of Pennsylvania (BA in Mathematics), Stanford University (MS in Operations Research), and Case Western Reserve University (PhD in Operations Research)
3. During a previous career at British Petroleum, I developed mathematical models of logistics systems. These models included linear programming models for oil and chemicals movements, mixed integer programming models for ship and pipeline scheduling, and several computer simulations of the Alaskan crude oil supply chain.
4. At British Petroleum, I was a logistics/supply chain manager (in a variety of positions) during most of my 28 year tenure. For BP Chemicals, I managed freight expenditures of \$200 million per year and for BP Oil I managed freight expenditures that were greater. I have managed rail and truck movements, a fleet of 2000 rail tank cars, operated tows on the Mississippi and the Gulf Coast, shipped potash on the Great Lakes, moved a lot of Alaskan and other crude oils by ship and pipeline both internationally and in the US, stored and moved chemicals through Europe and Asia as well as domestically, and started a private trucking company. I have extensive experience both operating logistics systems and negotiating rates with carriers.
5. I have a strong interest in the transportation infrastructure of the Great Lakes/St Lawrence, and completed a year-long project “Northeast Ohio Logistics Infrastructure” in late 2009 for NEOTEC (Northeast Ohio Trade and Economic Consortium).
6. I consulted for the Port of Cleveland for over a year to help them develop new waterborne business on the Great Lakes.
7. I have hosted three conferences on the John Carroll University campus in the past two years – two of which were titled “Great Lakes St Lawrence Marine Highway – Fitting the Pieces Together” (which had a water focus) and one titled “Northeast Ohio Transport Infrastructure Study” (which had a rail focus). The conferences brought together many stakeholders (shippers, carriers, ports, and government officials) of the Great Lakes and Northeast Ohio to generate business opportunities.

I have no real or perceived conflicts of Interest. I grew up on the Great Lakes and I just want the best of all things for the Great Lakes and our environment. I sincerely thank you for the opportunity to comment. I spent approximately 150 hours to prepare this review.

To: **Lauren Steele**
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105

From: **C. James Kruse**
Texas Transportation Institute
Texas A&M University System
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Email: j-kruse@ttimail.tamu.edu

January 12, 2011

Dear Ms. Steele:

The documents that I received from EPA (via RTI International) were a letter containing the charge questions and the study report by ICF International and Energy and Environmental Research Associates, LLC. I reviewed all of the documents that I received in developing my expert opinion as contained in the “Peer Review, Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping” submitted on December 1, 2010.

I declare that there are no real or perceived conflicts of interest concerning my involvement in this review for the U.S. Environmental Protection Agency.

I spent approximately 40 hours while performing this review.

Best regards,

C. James Kruse
Director, Center for Ports & Waterways
Texas Transportation Institute

Appendix E: Review Reports

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Review-1 by: Dr. Michael Belzer.

Peer Review, Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping

Dr. Michael H. Belzer

Wayne State University and Sound Science, Inc.

January 5, 2011

My overall impression of the assessment is that it is comprehensive and exhaustive and generally very well executed. From an economic perspective, it should not even be necessary to prove that transportation mode shift, source shift, and production shift would not occur. That is, a benefit/cost analysis would seek to demonstrate that the policy has a net benefit to society and this report shows that it achieves this benefit.² For the purpose required in this evaluation – to determine whether transportation mode shift, source shift, and production shift would occur – it meets the standard quite clearly. According to the text on page 1-7, the benefits exceed the costs by between 30:1 and 100:1.

To be very specific, benefit/cost analysis would determine whether the full benefit of the policy would exceed the full cost. If the higher cost of fuel resulted in a net cost that exceeded the health and climatological benefit of reduced environmental pollution, then there might be an issue. However, I have been informed by the EPA that the health effects of higher pollution due to lower grade fuels, and the costs of those effects, are not contested; that is, the amount of health risk and the cost of that risk is not in dispute. I do not see reference to climate-change issues in the chapters under review: Executive Summary and Chapters 1 through 3, inclusive.

With respect to mode, source, and production shifts, from the economic perspective, if the higher cost of fuel causes customers to source their products more nearby, then the products must be close enough substitutes that they should not travel such distances in the first place. In other words, if close substitutes do not shift closer then society must be subsidizing excessive freight transport distance, which would be bad public policy because the economics of the move would not pay the full cost. The researchers find that even those shifts do not occur, so the case is moot. Especially whether the product is iron ore or Michigan stone that is high in calcium carbonate, the product is sufficiently unique that it does not provoke a shift.

Incidentally, the paper makes reference to a possible disintermediation between raw iron ore and scrap steel. From my understanding of the steel industry, steel mills that use iron ore generally do not use scrap, and vice versa. That is, scrap mills generally do not require the resources that basic steel requires so they can be built farther from iron ore sources anyway. I do not believe that basic steel uses scrap either, so their incentives to relocate are even smaller than the report suggests.

² See Committee for Study of Public Policy for Surface Freight Transportation. 1996. *Paying Our Way: Estimating Marginal Social Costs of Freight Transportation*. Washington, DC: Transportation Research Board of the National Research Council; National Academies Press.

1) Clarity of the presentation

The executive summary and introductory chapter lay out the problem clearly. Chapters 2 and 3 get more complex, but it still is clearly written with few exceptions. For those who wish to get into the underlying methodology, which was not required for this review, the extensive appendix, which is the report written by the EERA consultants, amply documents the processes.

2) The overall approach and methodology

One might quibble with the sampling design for the sixteen cases because they were not drawn at random from among the possible cases, but these cases were selected from among the 50 cases suggested by those who had objected to the rule and who were concerned that these shifts would occur, so the selection process was biased conservatively at the outset. That is, since the cases were provided by the stakeholder community as possible instances in which these shifts would occur, we would expect that evidence would tend to support the contention that shifts would occur. They did not.

These cases had been recommended by the private sector objectors because it would have been impossible for the EPA to identify the population of all possible routings. However, at least one and perhaps two of the cases chosen were not apropos of the study because either alternative routes just did not exist or the short route leg on the Great Lakes suggested something else was going on. This could suggest that perhaps the EPA should have selected the sixteen cases they chose at random from the 50 cases available to them, but the chance of having been chosen would have been one in three, reducing the likely validity from the random draw. With the results so strongly repudiating the notion that the shifts would occur, it is unlikely that the selection used would have yielded much different results from a random draw.

It appears that the EPA selected these cases systematically in an attempt to fairly represent a cross-section of trips about which the private sector was concerned. One might also be concerned, however, that the EPA selected these cases systematically to identify O/D pairs that would least likely to trigger the shifts. While the critique can be made, it is a thin reed because the results so strongly refute the contention that transportation mode shift, source shift, and production shift would occur from the higher fuel cost. The only case studied that might support this contention is the odd case in which coal travels almost as far on rail in the rail diversion case as in the default case, and unique circumstances must allow this route choice in the first place. I discuss this below.

3) Appropriateness of the datasets and other inputs

The datasets used appear to be accepted by both the EPA and the shipping community. They appear to be the most appropriate ones for this situation. The data and methods appear to have consensual agreement.

4) The data analyses conducted

The first analysis determined whether mode shifts would occur. There is no evidence to support this contention. Researchers are correct to conclude that the increment of higher cost due to the fuel change is so small that it is lost in the noise of price changes. Indeed, the cost of some of these raw materials, most notably iron ore, coal, and grain, have increased dramatically just in the last year because of global demand for raw materials such as iron ore and coal, and weather-related pressure on grain prices due to the drought and fires in Russia in 2010. US public policy

that subsidizes corn production for ethanol has driven up grain prices even further. The additional fraction of a percent of cost for cleaner fuel is a very small increment – one that by itself would not be noticed in final price because other factors, such as the foregoing, put much greater pressure on price. The recent flooding in Queensland may have a greater impact on commodity prices than the cost of lower sulfur more refined fuel.

5) Appropriateness of the conclusions.

The conclusions drawn are appropriate based on the information analyzed. There is no question that cost increases due to this fuel will not cause the feared shifts.

Detailed comments, by page and section.

1-4: I am skeptical that the Great Lakes waterways would be an economically acceptable routing for intermodal short-sea container shipping. No container ships have been built for the Great Lakes and they probably could not hold more than two hundred containers, so this would only work for bulk shipments by container. No container ports exist on the Great Lakes. Containers more likely will travel by rail.³

On pages 1-14 through 1-25 the authors present an annotated literature review. The review is critical and evaluates the relevant previous studies. However, they uncritically report in section 1.7.1.1 the MNDot 1991 study having a purpose to “demonstrate”... that policy decisions ...can have important human health and welfare impacts”. That study should have been “evaluation”, not “demonstration”, but that’s not the problem of the authors of the present study.

On page 1-16 they review the MARAD 2006 study that evaluates short-sea shipping on the Great Lakes. This evaluation is sketchy and the fact that this shift has not happened, even as fuel price spikes made truck transport much more disadvantageous, suggests they may still have it wrong. I would suggest that the shift will be from truck to rail before it ever gets to short-sea shipping. The cost of time is significant and rail is much faster. I do not know if this study reviewed the Thomchick et al. study cited here.

1-24: In paragraphs 2 and 3 on this page, the report repeatedly refers to “realistic” and “normal” prices for fuel. I think it is difficult to forecast pricing and define normality in fuel pricing. Yes, fuel prices jumped far out of the norm by the summer of 2008, but the high fuel prices were speculatively driven and contributed to the ensuing recession. Fuel prices may have been unrealistically low before that point and may be starting to approach those 2008 levels as developing countries’ demand for fuel continues to rise in spite of the recession in the industrially developed countries.⁴ I would suggest using an objective standard based on a trend analysis of real historical prices and live with the consequences.

³ Thomchick, Evelyn A., Gary L. Gittings, John C. Spychalski, and Christopher M. Cassano. 2003. Analysis of the Great Lakes/St. Lawrence River Navigation System’s Role in U.S. Ocean Container Trade: Pennsylvania Transportation Institute. www.mautc.psu.edu/docs/PSU-2002-04.pdf

⁴ See Pfeifer, Sylvia. “Oil price ‘enters danger zone’”. *Financial Times USA*. Wednesday, January 5, 2011, page 1. This story highlights the fact that crude oil at this time is nearing \$100/barrel, even during a time of great global economic uncertainty.

1-25: The authors are correct to argue that “monetized health benefits are most likely significantly underestimated.” This is the hardest measure to develop. However, it is important also to emphasize that fuel prices and restrictions affecting air quality affects all modes, including truck and rail, which already have borne the cost of shifting to low-sulfur fuel. If the maritime sector were not required to use clean fuel, we might risk subsidizing that sector over the others, contributing to economic inefficiency and social inequity.

2-2: It would have been helpful if the researchers had attempted to find out the coal-supply route from the paper mill in Green Bay. Perhaps this was not within their scope or authority, but I suspect that the transfer costs in time and money would not make it worthwhile to make the long part-rail/part-ship route. It also is possible that the route through South Chicago is inexpensive because trains handle so much volume from Elk Creek to South Chicago that the ton-mile cost is lower via that combined rail/marine route than via the direct rail route.

2-6: The broadest type of economic model, a macroeconomic model such as that incorporated in REMI and IMPLAN, would be the best to do a full benefit/cost analysis. This was not required for this particular study and thus it was not necessary to incur the additional cost, as mode, production, and source shifts were in question in this case.

2-7: As discussed above, this report does not clearly specify the basis on which the EPA chose the sixteen routes among the fifty routes provided to them by stakeholders. Except generally for an attempt to incorporate all four broad commodity groups, the basis for the selection of these particular sixteen O/D pairs is never explained. The choices are not random, which normally would be preferred.

2-8: Did the EPA try to determine the specifics underlying the O/D pairs as discussed in Table 2-2? It would take some digging and investigation, along with cooperation, to determine what is going on for each case.

2-14: I wonder if they aren't using a per-barrel oil price that is too low to be “normal”? Using the 2007 price has the disadvantage of capturing a non-random point in time rather than a trend, and I would suggest an averaging or trend-based method across ten years or so.

2-15: With respect to last full paragraph in 2.6.3, I think that though the tradeoffs in fuel prices between marine and land-based distillate probably would remain constant, as stated in this section, but the tradeoff between the two might not be linear. As the price of oil goes up, the greater efficiency of using the marine mode might provoke shift of freight to marine over rail; this would happen at the extremes of price when the cost of fuel is so great that it begins to trump the cost of intermodal handling needed to shift as much to marine as possible. This, however, would not change the conclusions of the analysis because it would drive freight toward, not away from the marine mode; it would not favor truck or even rail.

While developed countries continue to have stagnant growth, many developing countries, especially in Asia, are experiencing rapid growth in demand for oil.

3-1: While I understand that mode, source, and production shift is the issue to be addressed here, from the economics and environmental perspective, these shifts are entirely acceptable and in many cases more efficient. In fact, if for some commodities the price of movement may be too great to support the move, and the sale and movement of the commodity would be foregone. From an economic perspective, this is an appropriate outcome. No matter what moon rocks are worth, the cost of obtaining them is prohibitively high for commercial purposes.

3-4: The current cost of diesel fuel is around \$3/gallon, plus taxes, and as noted above, many analysts anticipate it will continue to rise even in the short term despite global economic uncertainty.⁵ This just emphasizes the value of using a long-term price trend on which to base estimates. However, as long as fuel prices rise, systematic shifts likely will favor maritime over rail and rail over truck, so a low price probably leaves a very conservative result in this case.

3-13: Very technical clarification in first full paragraph. I would say “iron and steel sector” instead of “this sector”. Last full paragraph comment: the small increased price for steel would be absorbed in down-market competition, so you are correct to conclude that it’s negligible. Commenting also on the table, and repeating what has been said above, for all these commodities except perhaps stone, the marginal increase in cost for the transportation service will be swamped by the rising costs of the commodity globally.

3-18: Regarding the first paragraph and repeating what I discussed above, the markets for iron-ore-based production and scrap-based production are different. I am pretty certain that the crossover is negligible.

3-20: Top of page, last sentence in paragraph, refers to assumption that marine carriers have empty backhauls. I haven’t seen a reference to this before. Is this verifiable?

3-22, Table 3-11: It would be helpful if vessel emissions could be portrayed and measured the same way as this. Seems like the calculations are in different denominators and a translation must exist for this. It is hard for a reader to make the judgment without it.

⁵ Pfeifer, Sylvia. 2011. "Oil price 'enters danger zone'". *Financial Times* (USA), Wednesday, January 05, 1.

Review-2 by: Dr. Bradley Hull.

Bradley Z Hull PhD

**Associate Professor and Reid Chair
Department of Management, Marketing, and Logistics**

John Carroll University

Peer Review of “**ECONOMIC IMPACTS OF THE CATEGORY 3 MARINE RULE ON GREAT LAKES SHIPPING,**” Assessment and Standards Division, Office of Transportation and Air Quality, US Environmental Protection Agency

GENERAL COMMENTS ON THE STRUCTURE OF THE ANALYSIS

The study takes a two pronged approach to the HFO/MDO issue. First, it develops a cost comparison of all-rail versus rail/water routes for sixteen origin destination pairs. The goal is to establish that a switch from HFO to MDO will not result in a significant modal shift to rail. While the results of the analysis strongly suggests this result, it is not conclusive. A stronger argument is required. Here is why: The study utilizes a shortest route all-rail route for the origin/destination pairs, and also utilizes a cost based (I think) approach to compare the all-rail versus rail/water alternatives. In reality, railroads often don't use the shortest route, and don't use cost based methods to calculate their rates. Rather, they calculate their freight rates based on “differential pricing” methods (charging what the market will bear). In fact, railroads are famously known for using differential pricing to compete for waterborne traffic. Thus, though the analysis strongly indicates minimal modal shift to rail, the reality could be different. If you proceed with this analysis I urge you to add a validation step in which you select some of the sixteen origin/destination pairs, meet with the relevant stakeholder, and delve into details of the actual movements.

The second prong of this two pronged approach is important and necessary because it addresses the wider issue of industry competition – taking the study beyond the bounds of strictly modal competition. It takes a Great Lakes perspective of the steel, stone, coal, and power generation industries and evaluates the impact of the higher priced MDO on the ability of these industries to compete. Overall, I feel that each of the industry analyses can be improved (later in the document you will see detailed comments on each), and that more work needs to be done. The analysis should further include a look beyond the Great Lakes especially for the steel industry, due to its global nature.

I encourage the EPA to consider the following approach to the steel industry analysis: develop a linear program that models the mills on the Great Lakes and elsewhere and optimizes flows from mills to market. Next, perform a sensitivity analysis on the water transport costs to determine the extent to which MDO usage shifts steel manufacturing away from the Great Lakes to other steel centers. (The petroleum industry uses similar models to direct flows of crude oil from multiple origins through multiple waterborne and pipeline routes, to multiple refineries. It uses similar models to optimally route refined products from refineries to markets – I developed and worked with several of these models at BP). I am concerned that increased MDO costs might result in

global steel companies shifting production (to greater or lesser degree) from Great Lakes mills to their other mills. With the depressed state of the “rust belt” we don’t want to lose any more jobs.

A further factor to include in your steel industry analysis: Steel imports from Northern Europe to the Midwest are highly dependent on grain backhauls (steel ships need a grain backhaul to justify the inbound steel movement). To the extent that MDO usage reduces the availability of grain backhauls while simultaneously increasing the cost of steel fronthauls, steel movements into the Great Lakes become less economic. Eliminating the steel coil imports weakens the steel industry, because the European made steel coils are purchased for specialty uses.

In addition to the two pronged approach described above, I feel strongly that the EPA should add a third prong: the impact of MDO usage on the potential all-water imports and exports through the Great Lakes/St Lawrence – this is potentially a significant growth industry for the Great Lakes.

Here is the business opportunity for Midwestern cities located near the Great Lakes: The St Lawrence Seaway lies geographically on a straight line between the Midwest (large consuming population and industrial heartland), and Rotterdam/Antwerp (two of the largest world ports). This route has been cost effectively used by the steel industry for the past 50 years for importing steel coils from Northern Europe, but it is rarely used for general merchandise. (I will discuss the reasons with you if you wish) Based on the minimum mileage character of this straight line and the low cost of all-water transport, this route could benefit a host of imports/exports. As such, it is widely recognized as a potential growth business. Great Lakes ports, shippers, and carriers are studying ways to initiate service.

This is a MAJOR OPPORTUNITY for the EPA to reduce emissions in the Midwest and East Coast: As a large manufacturing and consuming region, the Midwest imports and exports considerable quantities between Midwestern cities and Europe. The routes currently used, though, require an overland leg by rail or truck (generating major emissions) between the Midwest and either Montreal or US East Coast ports, and then a waterborne leg between Montreal or East Coast ports and Rotterdam/Antwerp/Europe. If imports/exports were channeled through the all-water route, we would reduce emissions in the Midwest and East Coast, save transport costs, and take trucks off the roads. This would have a significant positive impact both to the Great Lakes as well as the East Coast environment. The Rhine River is an excellent example of such a working system, because the Rhine handles much of Europe’s commerce, reducing overland journeys through Europe by truck and rail, and significantly reducing emissions throughout Europe.

Relevance to the current EPA study: Montreal successfully competes with the US East Coast ports for deliveries to the Midwest, and approximately half of Montreal’s imports are destined for the US Midwest. Many Great Lakes ports, shippers and water carriers are evaluating the all water service to Europe described above. (few such services exist and I would be happy to discuss this further with you). Will the higher cost of MDO discourage the development of these many opportunities, giving further advantage to the high emissions overland routes to East Coast ports and Montreal?

In summary, with the internal Great Lakes industries in decline, we should encourage growth of new business opportunities, such as import/export – especially since this growth simultaneously cleans up the environment. The C3 study should address this topic.

RESPONSES TO THE CHARGE QUESTIONS PLUS ONE MORE

1. Clarity of the Presentation: The study is well written, but I have a few suggestions for “framing the problem,” especially in the opening pages, to enhance its clarity for a general audience.
 - a. State clearly that the study addresses Sulfur limits. In reading the study it took me awhile to understand this, because the study includes details on NOX and Particulates. My understanding now is that NOX and Particulates standards were previously justified and ruling has been made – they are secondary to Sulfur for this study. In my initial reading, I had felt that the NOX and Particulate limits were a subject of the analysis as well, and I wondered why the analysis was on sulfur only.
 - b. Demonstrate that ships are a major contributor to sulfur problems in the Great Lakes/St. Lawrence region. Your study hasn’t done that in a convincing way. Convince the audience. Provide a chart that shows ship emissions versus sulfur emissions from all the other polluters: trucks, railroads, automobiles, and manufacturers in the Great Lakes area. Convince the audience that adopting MDO will have a significant positive impact on the Great Lakes environment. Demonstrate that despite the fact that a large percentage of ship emissions occur in unpopulated areas, ships are major polluters in populated areas compared with shore based emissions sources.
 - c. Clarify whether the Seaway between Montreal and the mouth of the mouth of the St Lawrence River (a 500 mile long leg which exclusively runs through Canada), will require 100% MDO. I assume that this section of the River will continue to use HFO. Here is why: Montreal aggressively competes with US East Coast Ports to handle imports/exports for the US Midwest. Since the St Lawrence River downstream of Montreal runs exclusively through Canada, the many miles of using 100% MDO would negatively impact Montreal’s competitive position – an undesirable result from a Canadian point of view. I encourage you to address the issue and state what you feel is the most likely assumption, so that readers can better understand the areas of impact of the C3 Ruling. (As a parenthetical comment, both the Montreal and US East Coast port routes to Midwestern cities involve overland, high emissions truck/rail legs. The lowest emission route is all-water through the Seaway and the Great Lakes to Midwestern cities. Thus, it is important to protect the all-water route)
 - d. Please state the jurisdiction of the C3 Rule more clearly. I assume that the C3 Rule legally covers all ships travelling through or loading/unloading in US waters. If so, please state that. Due to the more-than-a-dozen border crossings, I assume that it de facto covers all ships travelling through Canadian waters in the Great Lakes as well. If so, please state that too.
 - e. Do sufficient quantities of MDO exist to support the C3 ruling? I assume so, but did not see this question addressed or analyzed in detail. This point should be cleared up to further establish the feasibility of the C3 Rule (and having worked in the petroleum industry I can offer some suggestions if you wish).
 - f. In the body of the text please distinguish between “rates” and “costs.” Your use of these terms was confusing at times and they seem to be used interchangeably. I am fairly certain that your analysis compares the costs of all-rail, versus the costs of rail/water transport. Unless you are adding a profit margin to these figures, please continue to refer to them as costs rather than as rates. This confused me

since railroads set their rates based on negotiations, using “differential pricing” or a “value of service approach.” (in fact, this is the method by which they famously compete with water transport) Their freight rates can and often differ widely from their costs.

More clearly defining the scope of the issues and the jurisdiction of the C3 Rule on the first pages adds clarity to the remainder of the presentation. Also, clarity is enhanced in the body of the text through items e and f above.

2. The overall approach and methodology need further clarification:
 - a. The EERA approach compares a minimum distance all-rail route with a minimum distance rail/water route. The rail routes are calculated using a model of existing rail tracks. Please check these routes for feasibility: are they heavily travelled trunkline routes, and do they involve multiple railroads? This is important since the routes are theoretically calculated rather than based on knowledge of actual routes being used.

While the shortest route is appealing, railroads often don't use the shortest route. Railroads want a long haul to gain economies of scale, and the long haul may not be the shortest, and may even be circuitous. In fact I have seen railroads utilize extremely circuitous routes just so they can preserve the long haul instead of having to share revenues by incorporating a second railroad. Also, railroads try to shift traffic to their most heavily used lines for economies of scale, density, and service. These heavily used lines may detract from the shortest route approach as well.
 - b. Are the routes from “item a” above evaluated on a “cost of service” or “value of service” basis? (I think that you are using “cost of service” but please clarify) A more clear definition of the calculation method and components is required. “Cost of service” builds up costs from the component operating costs of railroads and ships. It would include such factors as cost of cost of the train operating costs, winter layup for ships, tugs, lock fees, and pilot fees in calculating an overall voyage cost. Value of service would compare existing freight rates (which are very difficult to find due to their proprietary nature), and competitive positions of the railroads. Cost of service seems more appropriate for theoretically calculated routes. The EERA study uses rate/cost information from Chrisman Dager. It is important to understand the source of his information and whether it is cost or rate based. See references to Dager in part 3 below and on my comments about the EERA report. Further documentation of Dager's technique and information source is needed. It would be good if his input figures could be included in an appendix.
 - c. Railroads use “value of service” or “differential pricing” to value their services. In fact, on the Great Lakes and Mississippi River systems, they are known for drastically reducing their rates to attract business away from the water. This issue should also be addressed in the analysis, *and it puts the entire concept of “cost of service” pricing in question for this analysis.*
3. Appropriateness of the of the datasets and other inputs:
 - a. Dager provided many of the underlying rates/costs for the analysis. Are they rates or are they costs? If the analysis is cost of service, what component costs are

included and what was the source of the information? There are many such costs for both railroads and ships. For ships on the Great Lakes, costs include, US Flag hire cost, US crew cost, pilot fees, tug charges, lock delays on the Seaway, wintertime layup costs, and many more. Costs should be explicitly enumerated in the text. Similarly, if the analysis is based on value of service, how is this estimated (rail and ship rates are contractual and not published) and what is the information source (actual rates are very difficult to find)? Much better definition of his data set is required.

4. The data analyses conducted:
 - a. The EERA study provides a straightforward analysis of the Dager information.
 - b. Regarding the stone, coal, and steel analyses of Chapter 3, I would like a more thorough analysis done for coal, I felt the crushed stone analysis was quite good though it needs a review of its underlying data sources, and that the steel analysis and supplementary analysis needs to be revised to incorporate a more global perspective.

5. Appropriateness of the conclusions:
 - a. The EERA study addresses the impact of 100% MDO on internal Great Lake movements. With the Great Lakes industries on the decline, the study needs to consider the global marketplace and present and potential import/export opportunities, which is, after all the growth opportunity for Great Lakes as well as the rest of the economy.
 - b. Since the EERA model is theoretical and actual routes and rates may differ, I would encourage a final validation of the model by selecting a subset of the sixteen scenarios and interviewing shippers/carriers for their input and perspective.
 - c. The EERA study is suggestive but not conclusive. First the all-rail versus rail/water comparison is based on a cost model that may or may not be followed in the real world. Railroads and ship price their services on value of service instead of cost of service. This is especially true when they compete for waterborne business. Regardless of the fact that the EERA cases show that Great Lakes ships can absorb the increased cost of MDO without significant modal shift, the higher priced MDO can still result in less business overall, as manufacturers shift production away from the Great Lakes toward lower cost supply sources.
 - d. The stone, coal, and steel analyses of Chapter 3 are also not conclusive.
 - i. Stone shift analysis is stated as problematic, even by the authors, due to factors not included in the analysis. I happen to like the analysis a lot, but it makes several simplifying assumptions which need to be examined and validated, such as the use of theoretical transport costs from origin to destination, the assumption that highways are “straight line”, that Michigan specialty stone replaces local quarry stone on a ton for ton basis, and that heavy trucks are allowed on US highways. These assumptions need to be reviewed, but found the analysis otherwise very interesting.

- ii. Coal power is explained in a confusing way and the argument needs to be expanded. I spent a lot of time reading it, and would like the work done more explained further in more simple terms.
 - iii. I would like to see an expanded analysis of the steel industry since steel is so vital to the Midwest. The first discussion of steel assumes that water supplied coal is used in steel production, when in reality, the coal delivered by Great Lakes ships almost always goes to power plants. The supplementary analysis is more compelling but needs to factor in the need for grain backhauls and a wider marketplace. Also with the additional MDO costs added to limestone and iron ore movements along with additional MDO costs for steel imports and grain backhauls, it seems conceptually that the combined effect would be a significant negative for the competitiveness of the steel industry, vis a vis the steel industry elsewhere.

- 6. Impact of global marketplace is not included in the study, but should be included because it is the “growth business” of the Seaway. The Great Lakes has a significant quantity of captive business with iron ore, limestone, crushed stone, coal, and internal grain movement. However, these businesses have been on the decline since before 1990, and any growth for the Great Lakes/Seaway will necessarily come from increased import/export. Currently grain is exported (significant quantities this fall!), and steel coils/slabs have been imported for the past 50 years (using FedNav, Polsteam, and Wagenborg – none of whom is included in the study). Further, moves are afoot to deliver international containers to the Great Lakes (the Ports of Cleveland, Toledo, Erie/Conneaut, Ashtabula are all studying this, and Great Lakes Feeder Lines, McKeil Marine, and Wagenborg are interested carriers). Since this would create a significant number of jobs in the depressed “rust belt” and since this business would take trucks off the road, I believe that it should be included in the study. Here are three components that should be included:
 - a. Grain: Grain from the Midwest is shipped abroad via three main routes – by ship through the Great Lakes/St Lawrence, by rail to the US West Coast for loading to China, and by river barge down the Mississippi for export from New Orleans. My understanding is that the route chosen is highly dependent on transport rates, and small rate changes can have a major impact on choice of route. Would a requirement to burn MDO both ways on the 2000+ mile journey have a significant negative impact on the amount of grain routed through the Great Lakes? Page 7-26 of the study states that 70% of grain on the Great Lakes is destined for export, so this is an important case to be considered in the body of the report. Grain is an important export and should be explicitly analyzed.
 - b. Steel Coils: Steel coils are imported into the Great Lakes in the following manner. A breakbulk ship (typically FedNav, Polsteam, or Wagenborg) loads steel coils in Northern Europe for a variety of Great Lakes customers. The ship then crosses the Atlantic and transits the Seaway to discharge partial cargoes at Cleveland, Detroit, and Burns Harbor. When finished discharging, the ship picks up a grain backhaul and returns to Europe. Two issues need to be addressed:

- i. If use of 100% MDO on the entire Great Lakes/Seaway route has a significant negative impact on availability of grain backhauls, will steel coil imports become uneconomic?
 - ii. If the use of 100% MDO makes the (fronthaul) delivery of steel coils through the Seaway less economic, steel coils will likely be diverted to the East Coast ports for an overland rail/truck leg to Midwestern customers. (this is an alternative Midwestern route used by steel companies) In this case, the system generates more emissions from rail/truck. This alternate route is also considerably more expensive (that's why the all-water route to the Midwest is preferred) which then reduces the viability of the existing Midwestern steel companies.
- c. Containers: Containerships transit the Seaway as far as Montreal. At that point, the containers are transloaded to truck and rail for delivery to Canadian and US customers. The truck/rail movements generate high emissions. My understanding is that approximately half of the containers are delivered to the US. At present there are several moves afoot to extend container deliveries into the Great Lakes by water, possibly directly from Europe or by transloading containers to feeder ships or barges in Montreal or Halifax (the Ports of Cleveland, Toledo, Erie/Conneaut, and Oswego are the interested ports and Wagenborg, Great Lakes Feeder Lines, and McKeil Marine are interested carriers). Such a service would reduce SOX, NOX, and particulate emissions because it would replace rail and truck deliveries from Montreal and the East Coast. Would the 100% MDO ruling make this opportunity uneconomic?

DETAILED COMMENTS

The numerous comments below are listed page by page. I boldfaced some of the more important comments for emphasis.

Executive Summary

Page 10: Define “Category 3” engines in the text, rather than in a footnote, since the study is about them.

Page 13: I thought that steamships were permanently exempted from the ruling. The text indicates that a fuel waiver is available only until January 2015. Which is true? Please clarify.

Page 16: Provide more information on which stakeholders were consulted. Stakeholder buy-in is critical. This section only lists Lake Carriers Assn. and Canadian Shipowners Assn. That isn’t a lot of stakeholders. A full list should be included in the body of the study or in an Appendix. If the full list is confidential, you should try to characterize the list as best you can.

Chapter 1

At the beginning of Chapter 1, make the case that marine emissions are a big problem in the Great Lakes and St. Lawrence. This is the reason for having a C3 ruling in the first place. Present statistics showing that the Great Lakes are a non-attainment region and establish that marine emissions are a considerable percentage of those emissions. Add a table comparing the emissions from ships, trucks, railroads, automobiles, and factories showing the relative contribution of each to our densely populated region.

Page 1-4: Please document the degree to which ships contribute to the air quality in the region, compared with other emissions sources. From a novice’s point of view, the Midwest economy is depressed, and shipping is considerably off, so with few ships there will be few air emissions. Also, I would imagine that trucks, rail, and factories contribute a much greater share than do ships. If possible it would be useful to document this.

Page 1-5: Explain how the US EPA standards can apply to the Canadian Great Lakes ships of Table 1-3. I think that EPA standards would apply to US waters, and that EPA standards would be applied to Canadian ships because of the many boundary crossings they must make.

Page 1-5: The study looks only at sulfur standards in fuel and yet engine changes must be made to accommodate reductions in particulates and NOX. Please explain the relevance of NOX and particulates to this particular study, and explain why the cost of engine changes is not incorporated in the analysis.

Page 1-6: Ocean going salties “carry only a small share of cargo on the Great Lakes.” They are very important though because they represent the growth business for the Seaway, so it is important to consider them in the analysis. Elsewhere in this document I am recommending that you evaluate the steel movements of salties. Also there are a considerable number of “salties” that bring containers as far down the Seaway as Montreal and there are studies that show that

extending their reach to the Great Lakes is economic. Thus, it is important to determine whether this ruling will have a significant negative impact on these growth opportunities for the Seaway.

Page 1-7: With steam engines being excluded from the ruling, is it likely that they will be more heavily used by ship owners so that they can avoid retrofitting Category Three vessels?

Page 1-7: Please confirm that steamships are PERMANENTLY excluded from the ruling or list any conditions attached.

Page 1-8: North American ECA: Ships transiting the Seaway will travel many more miles with the North American ECA than will ships travelling from, say, Europe to an East Coast port. Thus the ruling will fall more heavily on Seaway transits than any other part of the North American ECA – true or false?

If true, then the main cost increases will be the ships that are either captive to the Great Lakes or FF ships that transit the Seaway. Thus, both types of ships should be reviewed.

Page 1-9: Add a bullet point describing the Seaway and Great Lakes components of the North American ECA. (you have bullet points for the other NA ECA components).

Page 1-9: In the summary, or earlier in the text, please be sure to explain how a US EPA ruling becomes incumbent on Canadian and Foreign Flag carriers. Are they included due to the fact that they travel through US waters? Are they included only if they unload at a US port? Are they included because it would be too complicated to track all the boundary crossings?

Page 1-11: Please reconcile the following two seemingly contradictory sentences:

- 1) "...we excluded Great lakes steamships from the ECA fuel sulfur requirements."
- 2) "...allows Great Lakes shippers to petition EPA for a temporary exemption from the 2015 fuel standards, which can encourage repowering steam engines to....."

Are steamships excluded permanently from the sulfur standards, or only until 2015?

Page 1-12: Please define "BAU" (business as usual) for the general audience.

The remaining pages of the chapter are quite interesting summaries of other studies. I think this is good to put your study in context, and very useful. I only have one comment on them below:

Page 1-22/23: I think the steel issue is one of extent, rather than one of relocating. A large, global steel company faces a worldwide demand and meets it with least cost. Thus if one of the steel mills owned by the global company experiences an increase in its transport cost to market, that mill will manufacture less, and another lower cost steel mill located elsewhere will manufacture more. Thus, a GL transport price increase would likely reduce the shipments "somewhat" rather than result in an immediate relocation. The amount of the reduction is often measured by a linear program.

Chapter 2 General (and important) Comment on Chapter 2: I believe that you should include a category for imported steel coils/slabs in addition to coal, iron ore, crushed rock, and grain, because there are an appreciable number of steel coils imported into the Midwest from Northern Europe by ship. (I can fill you in on more details). This would involve a breakbulk ship delivering steel coils from Northern Europe to the steel companies in Cleveland/Detroit/Burns Harbor, typically using a three port discharge, with a grain backhaul. This breakbulk ship voyage should be compared with another similar voyage to the East Coast for delivery to the same destinations by rail. Midwestern steel companies use both routes. I am concerned that the need to utilize MDO for the entire Seaway voyage will eliminate the Seaway route in favor of the water/rail route (which increases emissions and cost).

Page 2-2: Category Three ships must undergo modifications as well as fuel change. I believe the modification costs were not included in the analysis. What would be the impact if these were included?

Page 2-2: In Scenario 2, were the mine and paper mill stakeholders approached to try to better understand the situation? I think this might be a valuable way of validating the modeling approach, since the modeling approach did not seem to work. I recommend that you get into the details of Scenario 2 and talk with the shippers and carriers to find an explanation. Without such explanation, the result casts doubt on the results of the other Scenarios.

Page 2-5: Are the sulfur limits imposed on the Great Lakes/Seaway by EPA any stricter than those planned by the Canadians, or those planned for the US East Coast ports? Do the sulfur limits apply downstream of Montreal? What parts of the Lakes and St. Lawrence River are impacted?

Page 2-6: (IMPORTANT) Since the conversion to run MDO instead of HFO in Category Three ships is inexpensive, these costs can be effectively ignored. You should make this point in the analysis, as well as document it, because as you discuss modal shift, I kept wondering why you did not include the fixed costs of conversion

Page 2-6: By “flag neutral” I assume that the EPA requirements will be required of all US, Canadian, and Foreign Flag ships operating in US waters in the Great Lakes St Lawrence Seaway System. Correct?

Page 2-7: How did the EPA identify the stakeholders who provided the 50 O/D pairs? Who were the stakeholders? How did you winnow the list down to the 16 winners? Please provide a list of stakeholders either in the text or in an appendix. If the stakeholder list is confidential, please characterize them to the extent reasonable. The readers would like to know who was involved.

Page 2-10: I am concerned at the use of the GIFT model to calculate an optimal all rail route. This is because railroads negotiate rates based on “value of service approach” or “differential pricing.” This is charging what the market will bear, rather than a straight mileage times dollars per mile calculation. The rate and route also depends on how many railroads are involved and their individual routes – railroads all want to achieve long haul economics and as such may avoid a least cost routing that might extend over multiple railroads.

Page 2-13: The study refers to cost function modeling (which is cost-of-service, as opposed to value-of-service). Does the analysis strictly compare costs of two alternatives or does it compare rates? Rates would be more accurate but extremely difficult to accomplish with accuracy.

Page 2-14: I disagree with Section 2.6.2. I think that since the rail routes used are calculated a model, that we can't provide detail about the specific types of services. These calculated rail rates are critical to the results of the analysis. You should expand this one paragraph section to describe how you calculate the rail rates. Your analysis expects the reader to accept the rail rates you are publishing – so you need to provide backup as to how you arrived at them.

Page 2-14: For Great Lakes ships, if the study includes cost-of-service, it should include the cost of laying the ships up during winter, which will increase their costs. It must also include factors such as tug costs which will be required to position ships alongside docks, lock fees, pilotage fees which can be quite high, etc.

Page 2-15: You quote that MDO is expected to be 45.5% more expensive than HFO. Is that figure in \$/ton for both MDO and HFO? How does the btu content of MDO compare with HFO? What is the comparison in \$/BTU? I would think that the cost per BTU would be a more valid comparison of MDO and HFO.

Page 2-15: Please explain what you mean by freight rates. I think that you are building up the ship, rail and handling costs and adding some percentage of profit. Is this true?

Page 2-15: If this is a buildup of costs, then please provide a list of the component costs. For ships there are some costs unique to the Great Lakes that need to be included, such as winter layup cost, tug costs, pilot costs (which can be quite expensive), the high US Flag costs for maintenance and ops, and tolls – along with the more usual costs. Were these costs included?

Chapter 2, Appendix A

Overall Comment: Chrisman Dager's input is crucial to the analysis, and also undocumented. Please document his input and how he arrived at it.

Page 7: The study only includes the 16 identified captive Great Lakes cases, but does not include import/export along the Seaway. Also, no cost of converting engines to handle MDO is included. If the conversion cost is high it should be included in the analysis, otherwise the authors should establish that they are too small to bother with (as I think is the case).

Page 10: Other parts of the report state that there are 12 Category Three US Flag Ships, as opposed to the 8 referred to on this page. My understanding is that there are 12. With only 8 Category Three US Flagged Vessels, 57 Category Three Canadian Flagged Vessels, and numerous Category Three Foreign Flagged Vessels, the impact of the EPA ruling will fall mainly on Canadian and Foreign Flagged ships. Will the Canadian and Foreign Flagged ships require engine modifications too?

Page 12: With Category Three US Flagged Vessels using HFO, all will require retrofitting. Is the technology available currently to allow a changeover? The information on Page 13 indicates that the US Flagged vessels are quite large, so can the changeover present a problem?

Page 16: The no backhaul assumption can make shipping more expensive than the reality with backhauls.

Page 17: FedNav (Canadian flag and FF ship operator), Polsteam (Polish flag), and Wagenborg (Dutch flag) are breakbulk operators who operate a significant number of vessels between the Great Lakes and abroad. FedNav also operates within the Great Lakes. FedNav, in particular is a major ship operator headquartered in Montreal. They should be included in Table 14 and in the analysis. These are “salties” that bring steel coils into the Seaway and export grain.

Page 17: Algoma Central and CSL Group are the Canadian Flag operators who have the lions share of Category Three ships. Have they issued a position to the study?

Page 18: Most of the cases modeled involve US Port/US Port movement. These require one of the 8 (US Flagged vessels above, and the study indicates, these vessels are large. Does the ship analysis in this study account for this fact, or is it using generic Category Three ship figures? Also, with steamships being exempted, one might expect a shift from using US Flag Category Three ships to more fully utilizing steamships,

Page 19: Who is Chrisman Dager? He is providing the rail rates for the analysis and we don't know how he gets them? Does he build them up on a cost plus basis, or does he use knowledge of the existing rate structure, or some other method?

Pages 19-22: I believe that Chrisman Dager provided figures for FR_{BC} , $DTM_{dsr rail}$, TC_{dsr} and $DTM_{all rail}$. These figures are critical to the results of the analysis and their source and values should be documented.

Pages 19-22: In calculating the at-sea fuel cost, what size ship is used? More generally, the rail freight is calculated as a \$/ton figure times miles travelled, and the ship freight rates were provided by Chrisman Dager. Who provided the rail costs and how were these rail/ship freight figures estimated? If the ship rates were calculated on a cost of service basis, how were the old US Flag ships valued?

Sailing on the Seaway/Great Lakes differs from East Coast sailing, in that the speed limits are lower, there are several lock fees, wintertime layup costs, costs of US crews and ships, tug fees, and pilotage fees are an issue. I understand that pilotage fees can cost \$10,000 per day for foreign flag ships. Are these factors included in the analysis? If so, then they are factored in through the Dager analysis.

For the base case rail route in the scenarios, how do the routes chosen by the model compare with those actually used?

Page 23: Of the 16 cases, 12 require a US Flag ship. Are these ship moves presently being made by a steamship (exempted from the study) or one of the US Flagged Category Three ships? If the moves are steamship moves, shouldn't they be removed from the study? Are the remaining 4 cases handled by a Canadian Flag ship?

Page 26: How were fuel consumption rates calculated for the ships?

Page 26-29: It is nice to see that careful thought was put into the ship selection for each Origin/Destination pair.

Pages 24-29: in the Description of Input Assumption Sources please add a paragraph on how rail rates were calculate and another paragraph for ship rates.

Page 27-28: Rail distances. Railroads prefer one-line-hauls. If the movement is from a mine served b a single railroad, the origin carrier will want the long haul to achieve economies of scale. For this reason, rail movements are not necessarily the shortest distance route (and can be quite circuitous), especially if the shortest route involves two or more railroads. I would be curious to know if the model used selected a route with three or more railroads – since a route with more than two carriers is rare.

Pages 29-94

In the scenarios, I assume that the Base Case Route is the one that is actually used. Is this true, or are either the rail or ship portion generated by the Hawker model?

In the scenarios, does a switch from the Base Case Route to an All Rail route involve more emissions at destination? That is, for example, does a power plant emit more when it unloads rail cars or a ship? If this is true, is this factored in anywhere?

Scenario 2's Base Case looks crazy. I recommend that it be researched further. Why would anyone use a ship in this case? Does the base case reflect an actual movement? Is it possible that Georgia Pacific cant unload rail cars? Is the actual rail route the same as the one that the model chose? Is there an equity ownership involved?

Page 97: Please confirm that there is a rail ferry across the St. Lawrence River to Baie Comeau, QC. I have never heard of such! What are the sensitivities considered?

Chapter 2, Appendix B

Stakeholders were approached at Marine Community Day, an Ann Arbor workshop, the Canadian Shipowner's Association, and Lake Carrier's Association. These were likely representatives of the water carriers as opposed to representatives of the coal, stone, iron ore, and grain industries. Were stakeholders from these industries also included in the analysis? Please describe the stakeholders in the study.

Chapter 3

Section 3.1: **Source Shift (Crushed Stone):** I assume that power plants run a combination of trucked and ship/railed stone? Michigan's high calcium carbonate and low bond work index seems to be valuable because of its chemical properties for use in scrubbers.

Further I assume that a ton of Michigan stone, because of its unique chemical properties, must replace more than one ton of locally quarried stone. If this is true then we would want to encourage the use of long distance Michigan stone to reduce the number of truckloads of lower grade local stone. I suggest that someone from the stone industry (or one of the power plants under discussion) answer this question.

Section 3.1.2: Based on the reading and a subsequent phone call with the EPA here is my understanding of the method utilized: I believe that we start with the EERA model-calculated water/rail cost from the Michigan origin to a power plant, and then for this cost we draw a circle around the power plant to represent a competitive truck radius. This identifies the truck completion. We then look at expanding the truck radius by the extra ship MDO expenditure. As a result, the analysis is strongly dependent on the initial rail and ship cost figures provided by Dager (see my Chapter 2 remarks). The source of Dager's figures needs to be documented.

Water/rail deliveries versus truck deliveries of crushed stone:

1. **On Page 3-4, the analysis assumes oversized trucks with 43 ton cargos, rather than the 20 ton cargos allowed on Ohio's and Pennsylvania's roads (Pennsylvania's weight limit may even be lower than 20 tons). Is this a valid assumption?**
2. The study indicates that "anecdotal evidence suggests that truck rates may be higher, at \$20 per short ton more" than their analysis uses. This large discrepancy should be reconciled.

If the Bruce Mansfield Power Station is expected to see a partial modal shift, we should find out if the increased emissions of the additional trucks offset the emissions savings of the C3 ruling. Also, if the Power Station is outfitted to unload cars with few emissions, a conversion to truck may increase them. It wouldn't hurt to talk directly with the Station about their supply sources to validate your analysis.

The study states that the analysis is problematic because of factors not included, as listed in the last paragraph on Page 3-8. Further, if a shift from rail/water to truck occurs, the emissions consequences of this shift should be calculated and be included in the analysis. Still further, the shift analysis hinges on theoretical rail/water cost figures. Despite all that I think this is a very interesting approach.

Section 3.2: Production shift (Steel and Electric): Low cost steel and electricity producers typically run at capacity, while high cost producers expand or contract their production to meet the ups and downs of demand. By increasing the transportation cost of the inputs, we put the Great Lakes producers into the higher cost category, and as such they may lose production at times to the lower cost producers. This is probably a difficult concept to quantify. The classic example of such a potential shift is the new Thyssen-Krupp steel mill in Mobile. Thyssen has water access to the Midwest for its steel through the Tennessee-Tombigbee Waterway, and would like compete with the Midwest producers. As a new state of the art facility, they are high volume, low cost producer. Thus, perhaps the Great Lakes producer does not go out of business, but he will likely lose some business at the edge of his/her marketing area to companies such as Thyssen-Krupp.

Section 3.2.2: Impact on Great Lakes Sector: The Rosebud Mine is used for the lower and upper bound scenario and applied to electrical generation for the entire Lakes region. This is certainly a conservative assumption, since lots of the coal used does not even move by water, and some electricity is not generated by hydroelectric rather than coal. You might mention this in the text. Further in your analysis, you relate the transport cost increase to reduced electricity revenues. How do you calculate this inverse relationship? Is it a price elasticity argument?

Your argument in the last paragraph of Page 3-10 is difficult to follow. Please explain more fully how you separate the transport cost from the EIA figures. My understanding is that you use average figure for mine costs in East North Central, and subtract it from the “delivered coal cost.” Also, once you have subtracted the transport component, you must have to back out the percentage trucked and direct railed. Finally in using your baseline case freight rate, you are using the Rosebud Mine as indicative of the Midwest industry. I somehow am not understanding your argument or I am overthinking it. Please clarify for me and for others. It would be helpful if you would add some columns to Table 3-4 so that one could more easily follow your argument. Also, in the table you distinguish between public utilities versus independent power generators – but you don’t distinguish between them in the text. Please expand this section.

Section 3.2.3: Impact on Steel: I encourage you to add another row in Table 3-6 immediately above “transp cost increase % revenue” with the \$100.2 billion steel revenue figure. This would add clarity for people like me who like to reproduce the answers.

The argument is compelling but not complete in that you show that the MDO cost increase is a small percentage of revenues. However, as a percent of transport cost it can be between 8.5-16.6% for iron ore and 1.2-4.5% for coal. A company is quite capable of changing their shipping decisions based on such percentage increases in cost (especially for the iron ore percentages). A company’s shipping decisions are typically designed around minimizing manufacturing and transport costs. Revenues are calculated separately. If a steel company has no choice it may have to pay the difference, but the steel manufacturing decision may result in producing a bit less at the now-higher-cost Great Lakes plant and more at another plant.

My understanding is that Great Lakes coal movements are almost exclusively destined for power plants and almost none is used in steel production (steel companies usually use coke with is rail supplied). There are a few exceptions, like the Rouge steel plant in Detroit which occasionally received a shipload of metallurgical coal, but there aren’t many. Your table in this section seems to indicate that Great Lakes ships DO consume coal delivered by Great Lakes ships. This should be changed.

Section 3.2.4 Steel Production Shift: A Supplemental Analysis: The analysis in this section is both thought provoking and well done. I would like to ask the author a further question: An appreciable quantity of imported steel coils enters the Great Lakes from Europe. The steel coils are typically carried by FedNav, Polsteam, or Wagenborg. When these ships arrive in the Great Lakes, they discharge partial cargos at Cleveland, Detroit and Burns Harbor. After this, they pick up a grain backhaul and return to Europe (typically). This is a very cost effective movement that has been popular for the past 50 years! Competing for this business is a second movement from Europe. This second movement involves the same ships (or larger ships due to Seaway

limitations) delivering coils to the Philadelphia/New York area, where they are offloaded and shipped into the Ohio/Pennsylvania area by rail.

The question for the author is: to deliver breakbulk material such as steel (but of any type), what will be the increased cost of Seaway transit to cities such as Cleveland, Toledo, Detroit, and Burns Harbor. I believe that this question is quite important, specifically because there are many attempts to deliver international containers directly into the Great Lakes ports from Europe, rather than delivering them through New York/Phila/Baltimore with an overland freight leg. I am concerned that a large marine fuel cost increase on the Seaway might delay this shift to waterborne deliveries, and would like to understand the potential incremental cost per ton of cargo.

Page 3-15: The statement is made that a trip from Asia to LA can involve 1700 miles of North American ECA transit. How can that be? I thought that the NA ECA extended to 200 miles offshore only. If such a route exists, is it likely that that captain would take it when he can burn HFO for only 200 miles?

Page 3-17: Please check the fuel cost increased for the imported steel case. It seems to me that if imported steel moves through the North American ECA, all the way (1500 miles or so) down the St Lawrence and into the Great Lakes, that utilizing MDO at a 40% or so premium above HFO would significantly increase the transport cost. However, the figures on Table 3-7 do not reflect this, if true.

Page 3-17: Truth is stranger than fiction. Steel does move by water to East coast ports and then by rail to the Midwest. Norfolk Southern RR has a yard in Philadelphia dedicated to such moves.

Chapter 6

Page 6-1: Is it possible that we would refit a Category Three ship with a Tier 2 OR a Tier 3 engine?

Page 6-2: hardware costs of fuel switch are \$42k-\$71k!!! So little!! Say this at the beginning of the study, so that a reader does not feel that you overlooked what they may think of as a major fixed investment cost!

Page 6-8: Category Three ships do not need to be repowered under the ruling – only for company reasons, such as the existing power unit outliving the hull of the ship. This comment is important and should be more prominent in the beginning of the study.

Page 6-8: The repowering costs mentioned above are up to \$600,000 in addition to an engine replacement. Thus, they are extremely high. Does this pertain to steamships too, and will this contribute to them being retired?

Page 6-9: Seasonal layups are not included in the freight costs, but would likely be included in the actual freight rates charged to customers.

Page 6-11: PLEASE EXPLAIN THIS PAGE – WHERE DO THE STATS COME FROM?

Page 6-12: IN THE TABLE, ARE THE COLUMNS DIFFERENT SHIPS?

Chapter 7

Page 7-26: 70% of grain on the Great Lakes is destined for export, so this is an important case to be considered in the body of the report

Grain exports: Grain from the Midwest gets exported either through the Great Lakes, the Mississippi River, or the West Coast depending on market prices and transport cost. Adding cost to Great Lakes route will tilt the flow toward the other two routes to a degree. Can you quantify this? How much additional cost will be added and/or how much MDO versus HFO will be burned on the inbound and outbound voyages? (with 70% of grain on the Great Lakes destined for export, this is an important case)

Page 7-54: Please site the specific document from which you obtained Figure 7A-3.

Review-3 by: Mr. James Kruse.

PEER REVIEW

ECONOMIC IMPACTS OF THE CATEGORY 3 MARINE RULE ON GREAT LAKES SHIPPING

Reviewer: C. James Kruse, Texas Transportation Institute

In preparing these comments, I reviewed four documents:

- Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping, Chapters 1, 2, and 3
- Comment Letter from Canadian Shipowners Association, dated September 25, 2009
- Study of Potential Mode Shift Associated with ECA Regulations In the Great Lakes, August 2009
- EPA's Emission Control Program: Great Lakes Shipping, PowerPoint presentation dated February 11, 2010

I also participated in a conference call on December 21, 2010, that included a representative of RTI International, several representatives of the Environmental Protection Agency (EPA), and the other peer reviewers.

In reviewing the document, I focused on methodology, assumptions, and data sources. I did not attempt to do any grammatical or editing reviews, nor did I attempt to verify that computations were correct or that stated values were accurately imported from their sources.

For the most part, I found the document to be comprehensive and well-substantiated. Exceptions are noted in the attached comments. One facet of the analysis that is missing is the concept of equity. If ultra-low sulfur fuel requirements are being placed on trucks and locomotives, but not on marine engines, this would represent an indirect subsidy to marine. While the road to implementation may be markedly different, the requirements should represent a level playing field to the degree possible.

The charge letter requested that peer reviewers focus on 5 issues. These are addressed in the following paragraphs.

1. Clarity of presentation

By and large, the presentation is fairly easy to follow. There are a few things that could be done to improve clarity and readability:

- It would be helpful to standardize the units of measures for tons. Specifically, the document uses “tonnes”, “tons”, “metric tons”, and short “tons” (to name a few). Either the same “type” of ton should be used throughout the document or the unit of measure should be explicit each time any variant of “ton” is used.
- There are a lot of missing words and extraneous words. Correcting these editorial problems will help.

- On page 1-7, paragraph 5, the reference to “Section 1.1.4 below” doesn’t make sense. This is already section 1.4.2.
- On page 1-8, the document says “the level of fuels used in an ECA will decrease from 15,000 ppm to 10,000 in 2010”. We are already past 2010. Should it say “decreased” instead of “will decrease”?
- On page 1-9, the document states that France was instrumental in getting the North American ECA approved. Should it be Mexico? Omitted?
- Acronyms need to be spelled out at first usage. For example, on page 1-12, paragraph 1, what does “BAU” stand for?
- On page 1-22, paragraph 1, “go does” should be “goes down”.
- On page 2-6, the document states that “The purpose of this study is to examine whether an increase in fuel costs for Great Lakes shipping could lead to transportation mode shift”. This is extremely important in evaluating the analysis. I think this should be highlighted in the Executive Summary and at several points throughout the document.
- On page 2-9, the document states that “the analysis does not consider the transportation of the grain from the farm to the silo”, but does not state why. Although the reason may seem obvious, some explanation should be given.
- There are two issues with paragraph 1 on page 2-14: (1) The term “net tons” needs to be explicitly defined. (2) In three instances in this paragraph, the document states that the vessel weighs a certain amount. This is not true. It appears that the author intends to refer to “deadweight tonnage”, which is the weight of cargo, fuel, stores, and crews that the vessel can accommodate at its maximum load line—not the weight of the vessel. This needs to be clarified.
- On page 2-16, there is an excellent description of how the freight comparison was conducted. It might be useful to mention this in a couple of other places (e.g., executive summary), but not critical.
- In four scenarios shown in Chapter 2, Appendix A, there is no all-rail alternative considered, but the document does not explain why at this point. In the results section, the document states, “It was determined that xxxx is not serviceable by rail. Therefore an All-Rail Alternative Route does not exist”. The justification needs to be included on pages 53, 55, 57, and 59 as well.
- What is the unit of measure for costs In Table 3-6? Is it millions of dollars?

2. The overall approach and methodology

The approach of looking at origin/destination pairs that stakeholders thought might be affected is excellent. Given historical cargo flows, it also appears that the commodities that were chosen were appropriate. The involvement of stakeholders seems to be adequate and meaningful. Finally, there was an appropriate trade-off between accuracy and level of effort. My specific concerns about methodology are the following;

- In the CSA study dated August 2009, the authors state that “Transportation costs while an important factor in determining ore sourcing are often subordinate to considerations of ore quality, mine ownership, long-term contracts, and overall corporate benefit”. This should be noted in EPA’s analysis of the iron ore trade.
- In the document I reviewed, the analysis assumes that each voyage will have a revenue-generating backhaul. I have received a notice that backhauls were

considered to be empty in the analysis. If so, I do not have a problem with backhauls, as empty backhauls will state the worst expected case.

- I agree that focusing on the 2015 sulfur limit is the way to go.
- I have strong concerns about the methodology used for crushed stone. On page 3-3, the next-to-last paragraph states “It also does not examine the reason why the purchasing facility uses stone originating at a much longer distance, requiring ship transportation, when stone from local quarries may be available.” The existence of this situation in the “real world” invalidates the methodology used in the document. Users are importing stone from great distances for a reason. To simply expand the “competitive radius” as the basis of the analysis ignores this consideration. If the stone is being imported from a specific quarry, then the inclusion of quarries producing similar quality/grade stone needs to be evaluated rather than just looking at quarries generically.
- Would steel import quotas have an effect on this analysis? If so, that should be analyzed.
- I don’t see where the document addresses the concern the shareholders expressed regarding a potential spike in the price of the 0.1% sulfur fuel if there is a limited supply in the Great Lakes region when implementation begins.

3. Appropriateness of the datasets and other inputs

- In the CSA study, it was noted that neither Ontario steel mill has the facility to receive coal by rail. It would be wise to verify that the Algoma facility included in the analysis does have the facility to receive iron ore by rail.
- What is the basis or source for the statement on engine specific fuel oil consumption? How did EPA (or its contractor) derive the assumed propulsion powers?
- The source for the assumption on rail energy intensity needs to be stated.
- The current Great Lakes basin profile is for 2008. Table 13 in Appendix A should be updated.
- The sources should be stated for the following assumptions used to develop Table 16 in Appendix A: Auxiliary Engine power, Auxiliary Engine Load Factor in Port, and Rail Energy Intensity.
- In Appendix A, why is it assumed that the vessel will be loaded to 85% of its capacity? Since this assumption directly affects the unit freight cost, it is important to justify it.
- The Corps’ Port and Waterway Facilities data were used to obtain the depth of each port. I don’t know about the Great Lakes, but for the Inland Waterway System, these data are highly unreliable. Again, since available depth directly affects the unit freight cost, I would suggest some kind of “truthing” of these depths.
- In Chapter 3, is the assumption of a truck load of 43 short tons valid if the quarry is located in the United States?
- What is the basis for the assumption that 80% of the delivered iron ore cost is the “iron ore cost at the mine”?

4. Data analyses conducted

With the exception of the concern regarding stone quarry analysis noted above, I found the analyses to be appropriate and adequate. I have no further items of concern in this area.

5. Appropriateness of the conclusions

The conclusions were appropriate and justified, taking into account the data sources and inputs employed for the analysis. There were just two instances, where I felt the conclusions needed to be shored up. On pages 3-5 and 3-6 statements are made to the effect that “the increase is not substantial compared to the number of quarries already located within the radius.” This is a subjective statement that needs to be validated with numbers/data.

My comments are attached in tabular format. They are arranged in the order in which the underlying paragraphs in the document are presented—not in order of importance. The items I consider to be of greater importance have an asterisk (“*”) below the page number.

LISTING OF COMMENTS REGARDING ECONOMIC IMPACTS OF THE CATEGORY 3 MARINE RULE ON GREAT LAKES SHIPPING

Page	Paragraph	Comment
General		It would be helpful to standardize the units of measures for tons. Specifically, the document uses “tonnes”, “tons”, “metric tons”, and short “tons” (to name a few). Either the same “type” of ton should be used throughout the document or the unit of measure should be explicit each time any variant of “ton” is used.
General		There are a lot of missing words and extraneous words.
General		The involvement of stakeholders seems to be adequate and meaningful.
General		I don’t see where the document addresses the concern the shareholders expressed regarding a potential spike in the price of the 0.1% sulfur fuel if there is a limited supply in the Great Lakes region when implementation begins.
General		In the CSA study dated August 2009, the authors state that “Transportation costs while an important factor in determining ore sourcing are often subordinate to considerations of ore quality, mine ownership, long-term contracts, and overall corporate benefit”. This should be noted in EPA’s analysis of the iron ore trade.
General		In the same CSA study, it was noted that neither Ontario steel mill has the facility to receive coal by rail. It would be wise to verify that it does have the facility to receive iron ore by rail.
1-7	5	The reference to “Section 1.1.4 below” doesn’t make sense. This is already section 1.4.2.
1-8	2	The document says “the level of fuels used in an ECA will decrease from 15,000 ppm to 10,000 in 2010”. We are already past 2010. Should it say “decreased” instead of “will decrease”?

Page	Paragraph	Comment
1-9	0	The document states that France was instrumental in getting the North American ECA approved. Should it be Mexico? Omitted?
1-12	0	At the end of the paragraph, should probably use “metric ton” instead of “tonne”. (See general comments).
1-12	1	What does “BAU” stand for? Please write it out.
1-22	1	“go does” should be “goes down”.
2-5	2	I agree that focusing on the 2015 sulfur limit is the way to go.
2-6 *	3	The document states that “The purpose of this study is to examine whether an increase in fuel costs for Great Lakes shipping could lead to transportation mode shift”. This is extremely important in evaluating the analysis. I think this should be highlighted in the Executive Summary and at several points throughout the document.
2-9 *	1	The document states that “the analysis does not consider the transportation of the grain from the farm to the silo”, but does not state why. Although it may seem obvious why, some explanation should be given.
2-14	1	There are two issues with this paragraph: (1) The term “net tons” needs to be explicitly defined. (2) In three instances in this paragraph, the document states that the vessel weighs a certain amount. This is not true. It appears that the author intends to refer to “deadweight tonnage”, which is the weight of cargo, fuel, stores, and crews that the vessel can accommodate at its maximum load line—not the weight of the vessel. This needs to be clarified.
2-14 *	2 & 3	What is the basis or source for the statement on engine specific fuel oil consumption? How did EPA (or its contractor) derive the assumed propulsion powers?
2-14 *	4	The source for the assumption on rail energy intensity needs to be stated.
2-16	1	This is an excellent description of how the freight comparison was conducted. It might be useful to mention this in a couple of other places (e.g., executive summary), but not critical.
2A-13	1	According to what the document says on 2A-16 and what the carriers state, vessels that carry iron ore can also carry grain.
2A-15	Table 13	The current Great Lakes basin profile is for 2008. The table should be updated.
2A-24 *	Table 16	The sources should be stated for the following assumptions: Auxiliary Engine power, Auxiliary Engine Load Factor in Port, and Rail Energy Intensity.
2A-26 *	2	Source for specific fuel oil consumption parameters?
2A-26 *	5	Why is it assumed that the vessel will be loaded to 85% of its capacity? Since this assumption directly affects the unit freight cost, it is important to justify it.

Page	Paragraph	Comment
2A-27 *	4	The Corps' Port and Waterway Facilities data were used to obtain the depth of each port. I don't know about the Great Lakes, but for the Inland Waterway System, these data are highly unreliable. Again, since available depth directly affects the unit freight cost, I would suggest some kind of "truthing" of these depths.
2A-53, 55, 57, & 59		In four scenarios, there is no all-rail alternative considered, but the document does not explain why at this point. In the results section, the document states, "It was determined that xxxx is not serviceable by rail. Therefore an All-Rail Alternative Route does not exist". The justification needs to be included on pages 53, 55, 57, and 59 as well.
3-2 ff **		I have strong concerns about the methodology used for crushed stone. On page 3-3, the next-to-last paragraph states "It also does not examine the reason why the purchasing facility uses stone originating at a much longer distance, requiring ship transportation, when stone from local quarries may be available." The existence of this situation in the "real world" invalidates the methodology used in the document. Users are importing stone from great distances for a reason. To simply expand the "competitive radius" as the basis of the analysis ignores this consideration. If the stone is being imported from a specific quarry, then the inclusion of quarries producing similar quality/grade stone needs to be evaluated rather than just looking at quarries generically.
3-4	2	Is the assumption of a load of 43 short tons valid if the quarry is located in the United States?
3-5	2	The last sentence states, "...the increase is not substantial compared to the number of quarries already located within the radius." "Not substantial" is subjective. I suggest including some numbers here.
3-6	1	See previous comment.
3-9	3	Would steel import quotas have an effect on this analysis? If so, that should be examined here.
3-12	4	What is the basis for the assumption that 80% of the delivered iron ore cost is the "iron ore cost at the mine"?
3-13	Table 3-6	What is the unit of measure for costs? Is it millions of dollars?

Appendix F: Additional Documents Provided to the Reviewers

Particulars	Page
1. List of additional documents provided to the reviewers	F1
2. Document “Marine Community Day Presentation” by Byron Bunker	F2-F20

List of Additional Documents Provided to the Reviewers

- 1) U.S. EPA Appendix 2B “Stakeholder Interactions” to Chapter 2 of the EPA “Economic Impacts of the Category 3 Marine Rule on Great Lakes Shipping” (June 10, 2010);
- 2) Stakeholder “Attendee List” (June 10, 2010);
- 3) U.S. EPA Marine Control Program: “Marine Community Day Presentation” (February 11, 2010) [Available in Appendix F of this memorandum];
- 4) “Comments of the Canadian Shipowners Association on the United States Environmental Protection Agency’s proposed rulemaking entitled “Control of Emissions from New Marine Compression-Ignition Engines at or above 30 Liters per Cylinder” (September 25, 2010 EPA-HQ-OAR-2007-0121);
- 5) Research and Traffic Group “Study of Potential Mode Shift Associated with ECA Regulations In the Great Lakes” (August, 2009);
- 6) U.S. EPA “Control of Emissions from New Marine Compression-Ignition Engines at or above 30 Liters per Cylinder – Information in Support of Applying Emission Control Area (ECA) Requirements to the Great Lakes Region” (December 15, 2009 EPA-HQ-OAR-2007-0121-0586);
- 7) U.S. EPA “Summary and Analysis of Comments: Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder” (December, 2009 EPA-420-R-09-015).

EPA's Emission Control Program: Great Lakes Shipping

**Marine Community Day
February 11, 2010**

**Byron Bunker
U.S. Environmental
Protection Agency**



Overview

- Summary of Marine Engine, Fuel Programs
- Congressional Direction
- Great Lakes Provisions
- Great Lakes Study



EPA's Marine Program

- Comprehensive program - marine engines and fuels

- Coordinated strategy

- Clean Air Act
- MARPOL Annex VI
- Emission Control Area Designation
 - ECA designation expected to be adopted at IMO March 2010



Marine Diesel Engines

- ◎ NO_x, PM
- ◎ 2008 Loco/Marine Rule
 - ◎ New Category 1 and 2 engines
 - ◎ Reman Category 2 engines
- ◎ 2009 Rule/MARPOL Annex VI Amendments
 - ◎ New engines > 130 kW
 - ◎ Existing Category 3 engines

Marine Fuels

- ◉ Sulfur and PM

- ◉ Fuels produced, distributed in US (CAA program)
 - 15 ppm distillate by 2014
 - 2004 Clean Air Nonroad Diesel Rule

 - 1,000 ppm ECA fuel by 2015
 - 2009 Category 3 Marine Rule

- ◉ Fuels used in North American ECA (ECA program)
 - 10,000 ppm by 2012
 - 1,000 ppm by 2015

U.S./Canada ECA Proposal



Result: Reduced Ship Emissions

◎ NO_x Controls

- ~ 80% NO_x reduction new vessels (2016)

◎ PM and SO_x Controls

- ~95% SO_x reduction
- ~85% PM reduction



◎ Shipping will be efficient and clean!

Human Health & Welfare Benefits: Category 3 Rule

- ◉ 2030 estimated benefits are between \$110 and \$280 billion
- ◉ By 2030, program expected to prevent:
 - Between 13,000 and 32,000 PM-related premature deaths
 - Between 220 and 980 ozone-related premature deaths
 - Up to 1,500,000 work days lost
 - Up to 10,000,000 minor restricted-activity days
- ◉ Estimated annual costs are much smaller: \$3.1 billion

Human Health & Welfare Benefits: 2008 Loco/Marine Rule

- 2030 estimated benefits are between \$9 and \$11 billion
- By 2030, program expected to prevent:
 - 1,100 PM-related premature deaths
 - 280 ozone-related premature deaths
 - 120,000 work days lost
 - 1,100,000 minor restricted-activity days
- Estimated costs are much smaller: \$740 million

Great Lakes Shipping

- U.S. ship owners and Great Lakes industry associations contributed to our marine actions

- 2003 Tier 1 Rule
- 2004 Locomotive and Marine Rule
- 2007 Ship ANPRM



- Environment Canada, Transport Canada, and Canadian ship owners also participated

Great Lakes Vessels

- **Lakers: ECA fuel sulfur requirements on the Great Lakes will –**
 - Put steamships out of use –distillate fuel causes safety concerns
 - Increase operating costs, leading to significant modal shifts to rail or truck
- **Result will be emissions increase, from rail and truck**

Direction from Congress

- 2010 Appropriations Bill (HR9226, the Department of Interior, Environment, and Related Agencies Appropriates Act, 2010)
- EPA directed to exclude Great Lakes steamships from fuel sulfur standards
- Bill Report: EPA should include 2 waivers (fuel availability, economic hardship), do study)

FRM Provisions for Lakers

- ◉ 40 CFR 1043.95
- ◉ Steamships excluded from fuel requirements
- ◉ Diesel ships: compliance waived for 10,000 ppm fuel if that fuel is not available - but owner must purchase the next cleanest fuel available
- ◉ Serious economic hardship provision
- ◉ Canadian vessels are also eligible – Annex VI Compliance on the Lakes

Great Lakes Economic Study

- What are the impacts of fuel sulfur requirements on Great Lakes shipping?
- How do we evaluate this question?
 - Methodology
 - Data needs
- Developing stakeholder process to carry out this study
- Assessing existing methodologies



Additional Information

- 2009 Category 3 Marine Rule and North American ECA
 - www.epa.gov/otaq/oceanvessels.htm
- 2008 Loco/Marine Rule
 - www.epa.gov/otaq/marine.htm
- General Marine Program Contact
 - Jean-Marie Revelt
 - U.S. Environmental Protection Agency
 - Revelt.Jean-Marie@epa.gov
 - (734) 214-4822

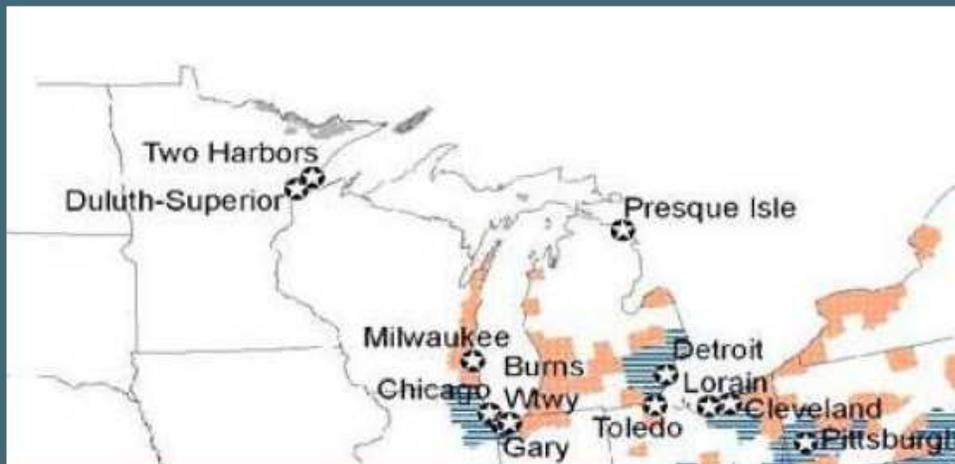
Appendix

Impacts of Great Lakes Vessels on U.S. Air Quality



Great Lakes Ports and Nonattainment Areas

- Great Lakes shipping about 1.5% of the emissions and fuel consumption in the U.S., but their impacts are localized on the Lakes



Great Lake Vessel Contribution

- About 1.7% of the PM benefits of Category 3 engine and fuel controls in the U.S. are achieved in 6 Great Lake states (IN, IL, MI, MN, OH, WI)
 - PA and NY not included because they also border Atlantic Ocean
- Estimated benefits of controls on Lakers is –
 - \$1.5-3.7 billion in benefits v. \$0.05 billion in costs
 - In comparison, the total benefit of Category 3 marine rule in 2030, for the full U.S. ECA, is \$110-\$260 billion, with \$3.1 billion in costs, for similar benefit-to-cost ratio

2020 Potential PM2.5 Reductions

