Stolen Direct Testimony on Behalf of Friends of the Headwaters, Ex. 180

FRIENDS OF THE HEADWATERS

MINNESOTA PUBLIC UTILITIES COMMISSION

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DIRECT TESTIMONY OF PAUL STOLEN

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I. INTRODUCTION REGARDING QUALIFICATIONS – PURPOSE OF TESTIMONY.

Q: State your name and employment status.

A: My name is Paul Stolen, and I am retired from a number of different state government agencies in Minnesota and Montana, which also included one period of working for a consulting company.

Q: For whom are you testifying?

A: I am testifying on behalf of Friends of the Headwaters ("FOH").

Q: Have you testified in proceedings in front of the Public Utilities Commission before?

A: No. I have prepared policy papers, testified in court, and given depositions, but I have not testified in front of the Minnesota Public Utilities Commission ("PUC").

Q: What is your educational experience?

A: I have a both a Bachelors and Masters of Science in Wildlife Management from the University of Minnesota. Right after the MS degree, I studied animal behavior and have published several articles about waterfowl behavior in refereed journals. Shortly after that I entered the Master of Art program in the University of Minnesota in School of Journalism with a minor in the Hubert Humphrey School of Public Affairs. At the Humphrey School I studied environmental policy and the scientific research leading to Genetically Modified Organisms, which was controversial research at the time. I wrote a paper on this topic that was later used in support of a law passed by the Minnesota Legislature requiring that GMO releases in some instances be subject to environmental review.

Q: What is your work experience?

A. After school, I had an internship with the Minnesota Environmental Quality Board ("EQB") staffing the Power Plant Siting Advisory Citizens Committee, which conducted a review of the state regulations regarding large energy facilities. I also worked for the Minnesota Legislature, conducting a program review of the Legislature's Science and Technology Project, as well as staffing an environmental committee. This program was created by a National Science Foundation grant to establish better science and engineering understanding in the Legislature. I also worked as staff for the Joint Committee on Solid and Hazardous Waste.

From 1979 to 1985, I worked as a Project Manager and Special Projects Coordinator in the Montana Department of Natural Resources and Conservation, Energy Division. My duties primarily consisted of conducting environmental review and managing the drafting of

Environmental Impact Statements ("EIS"). This position also involved conducting joint federal-state EISs. Projects included water diversions, large coal-fired energy facilities, large transmission lines, hydroelectric dams, pipelines, and wind projects. I also assisted in re-writing the environmental review regulations. A special project was supervising the preparation of two major reports on the biological effects of electromagnetic fields associated with high voltage transmission lines.

I continued environmental review work in 1986 and 1987 at a private consulting firm now owned by URS Corporation. That position involved preparing environmental assessment worksheets ("EAWs") and environmental permits. From this position I transitioned to the DNR where I worked until I retired in 2009. I began my career at DNR as an Operational Planner in the Fish and Wildlife Division. I worked on strategic, operational, and long-range planning on a team, with the main focus often being implementing a new budget management system in this Division. I also assisted with the creation of the regional environmental review staff (of which I was one of the first hired in Bemidji) by writing the justification for the Legislative appropriation.

In 1990, I began my position at DNR as Regional Environmental Assessment Ecologist for the Northwest quarter of Minnesota. I was responsible for reviewing, among smaller projects, complex—often politically sensitive—projects affecting the environment, and coordinating with state, federal, and local agencies to try to reduce regulatory complexity. This included reviews of large flood control projects and hundreds of reviews of many other types of projects. The two most significant projects I worked on were, first, several controversial water diversion projects proposed by North Dakota that affect Minnesota, and second a Generic Joint Federal/State EIS on flood control projects in Minnesota.

Q: What is your experience with developing or reviewing government policy regarding facilities that potentially have large consequences to the environment?

A: During my Montana employment I coordinated the re-writing of the environmental review portion of regulations for Montana's Major Facility Siting Act, and wrote portions of them. At the time, this law incorporated need, location, and environmental review requirements and decisions all in one law. I prepared for the rule creation by doing a review of all state environmental review programs in the USA, as well as US federal and Canadian environmental review law and regulations, including the NEPA Deskbook. Also, the Scope of Work that I

created for the contract to study electromagnetic fields effects of high voltage power lines led to adoption of a Montana state standard for proximity of large power lines to residences, the first in the nation. I was an advisor to the Montana Board of Natural Resources during their debate about adopting this standard. After returning to Minnesota, I was hired as a facility siting specialist by BRW, Inc. (which had a contract with the White Earth Indian Reservation) primarily to review a proposal to locate high level nuclear waste sites that would affect Native American land and resources. I wrote a 76 page report that allowed White Earth to set policy based on sound technical information about this proposal. While later working for the Minnesota DNR, I was the main state representative working with state and federal agencies, and the Canadian provincial and federal governments, on the two proposed interbasin water transfers potentially negatively affecting Minnesota and Canadian ecosystems. This included working with the US State Department, and Canadian Foreign Affairs agency in Ottawa and at the Canadian Consulate in Minneapolis.

Q: What is your experience with risk assessments?

A: While I was representing the Minnesota DNR regarding the two interbasin water transfer proposals, I developed a critique of a large USGS risk assessment done for the US Bureau of Reclamation concerning the transfer of biota not found in the Hudson Bay drainage from the Missouri River basin. This involved obtaining expert assistance from a scientist knowledgeable about the details of risk assessment methods. I also reviewed the Oak Ridge National Laboratory risk assessment discussed in Appendix 1 regarding block valves on pipelines. During my work history, I also reviewed methods of forecasting impacts that would be viewed as preliminary to creation of numerical risk assessments.

Q: What is your experience with pipelines?

A: My experience with pipelines began in college when I was a laborer on the bending crew during the construction of a large diameter pipeline in the vicinity of Bemidji Minnesota. Over the course of my government career, I have been involved in approximately 12 pipeline projects in various roles, including managing an EIS on one project. I was the state environmental inspector for a Montana project and part time inspector on several other pipeline projects in Minnesota. I have given training sessions on pipeline construction as it relates to techniques of identifying impacts and mitigation and on the ins and outs of pipeline construction. I have prepared a report on the right of way requirements of large diameter pipelines that has seen

extensive use for training and determining right of way requirements. Pipeline projects have included natural gas, crude oil, carbon dioxide, and water lines. I have testified in court as an expert witness on one pipeline project.

I.B. What is the purpose of your testimony? Please outline its major components along with short statements as to implications and findings.

I.B.1. Intended audience for this testimony. This testimony is specifically submitted to the Public Utility Commission (PUC) for use in the fact-finding process for the necessary regulatory decisions concerning the Sandpiper proposal. In my regulatory career, I have been involved in a number of difficult and large projects that have generated a large amount of public interest and intensive study by government agencies. The purpose of this testimony is to join together all the various pieces that will—or should—enter into government decisions on such projects. Often, on such projects, these pieces don't become clear until it is too late to develop a more orderly and democratic decision process. I have received a number of questions from citizens who know my experience with pipelines and other large projects. It is also evident that the Enbridge projects and oil transportation in general are receiving wide attention, and questions, from large numbers of public officials.

The format and content of this testimony is intended to provide information on the key elements of the technical and public policy issues and implications of these proposals, both to the PUC and to the public that I have tried to serve throughout my career. My understanding is that the PUC members and its staff are broadly receptive to participation by interested parties. While this testimony is submitted under the name of Friends of the Headwaters (FOH), I have developed it as an unpaid interested citizen who happens to have in depth experience with pipelines, natural resources and environmental review of large and complex projects. The content is certainly based on suggestions from FOH, but it also based on my understanding of what citizens and public officials need and expect from someone with my background. I have tried to make the testimony readable to the interested public. I hope I have succeeded.

The testimony is also intended to be useful in scoping issues to be included in an EIS.

I.B.2. What pipeline projects are the subject of my testimony? My testimony focuses on two proposed Enbridge projects, and three recently approved and constructed large pipeline projects in Minnesota. The inclusion of the latter three will become evident in my testimony. These projects are:

I.B.1. New Enbridge projects. Minnesota public officials are faced with decisions on the need for and location of two large Enbridge pipeline proposals. As proposed by Enbridge, the first of these is the Sandpiper project intended to carry oil in a 24-inch pipe from North Dakota's Bakken field east to Clearbrook, then south with a 30-inch pipe to Park Rapids, then east on to Superior, Wisconsin. The second is a 36-inch Enbridge pipeline, that is to replace and enlarge (by about 12% in volume) Enbridge's older Line 3, (a 34-inch pipe), and will carry Canadian tar sand oil. According to Enbridge, it is proposed to follow Enbridge's Mainline Corridor from Canada to then join Sandpiper near Clearbrook, then follow the Sandpiper proposed route to Superior.

I.B.2. Three large recent pipeline projects. These included the 36-inch Alberta Clipper and 20-inch Southern Lights projects which were finished in 2010 in Minnesota. They followed the existing Enbridge Mainline Corridor to Superior Wisconsin, and carry tar sand oil from Alberta, and diluent back to Alberta from refineries. This mainline corridor already had multiple other pipelines in it. The third project was the 24-inch MinnCan project from Clearbrook to refineries in the Twin Cities. It followed a corridor created years ago by two smaller and older pipelines for most of its route. It was completed in 2008 and 2009. The two new Enbridge projects are proposed to follow that corridor from Clearbrook to Park Rapids, then turn east to follow a new pipeline route to Superior.

I.C. Is a Minnesota Environmental Impact Statement (EIS) required and necessary for the Enbridge Projects?

One of the purposes of my testimony is to indicate that an EIS on these projects must be accomplished because testimony so far in the PUC proceedings indicate that the Certificate of Need decision by the PUC is a state action subject to the Minnesota Environmental Policy Act—separate from the Route Permit decision. Legal briefs previously filed in this docket have described how the responsibility to prepare environmental studies for the Route Permit was given in 1989 to the Department of Commerce and PUC as an alternative review process. However, according to those same briefs, the MEQB did not transfer the Certificate of Need responsibility to these agencies, and therefore, it appears that the Comparative Environmental Assessment for the Route Permit does not apply to the Certificate of Need decisions.

Furthermore, the rules for the CN need decision clearly list separate environmental criteria than those found in the Route Permit rules. These CN criteria also cover review of alternatives—

including establishing the foundation that a CN could be denied on the basis of environmental impacts and a poor choice of routes.

Of course, I am not a lawyer and am not supplying a legal analysis. However, I do believe my career as a civil servant, regulator with responsibilities for applying law and regulations to particular situations, and my work preparing, coordinating and commenting on environmental review documents make me competent to interpret how policy—as listed in rules—applies to methods of assessing impacts and comparing alternatives. Therefore, this testimony provides information that informs—based on the criteria in the CN rules—the decision on whether to grant or not grant a Certificate of Need. I believe it is both good law and good policy to prepare an EIS based on my experience.

To my knowledge, and in my personal experience, a Minnesota EIS has never been done on any of the large pipelines that are currently located in Minnesota. Under Minnesota policy, an EIS is required if there is the "potential for significant environmental effects." My testimony will review what is involved concerning this potential as it applies to the two Enbridge proposals. I believe it provides clear and convincing evidence that the answer is yes, there is such potential and that an EIS is appropriate. Furthermore, given the very rapid—and historically relatively surprising—rapid expansion of North American oil and natural gas supplies, and Minnesota's location between supplies and markets, my testimony indicates this is time to objectively study the implications to natural resources and people as well as alternative locations and transport methods.

I.D. Physical and operational magnitude of the Enbridge proposals. Project magnitude is directly relevant to whether "there is the potential for significant environmental effects." The purpose of this part of the testimony is to describe the large magnitude of these projects. In making a finding that there is the potential for significant effects, there are three main elements to be considered in this case: a) the physical magnitude—sometimes called the "environmental footprint"—of the projects, b) whether the location of the projects increases the potential effects, and c) whether events during the operation of the project can heighten the magnitude of potential effects. Obviously, pipeline leaks, ruptures, potential explosions, and so forth are all potential operational effects. For the sake of my testimony, I have selected a project life time frame of 50 years, which is often used in the case of large projects that are built to last.

I believe my testimony will show that each of the above factors—even individually—provides justification for a finding that an EIS is the proper approach. Furthermore, the testimony will explain that standard risk assessment approaches have a foundation principal: that for any complex technological system, if the potential damage or consequences of failure is very high, it is imperative that rare events—even very rare events—be examined to determine, first the

potential magnitude and consequences of the failure, and second, whether the facility should be located in a location that will suffer less damage if the system fails.

The magnitude of the Enbridge projects is very large in every way. For example, my testimony indicates that the flow of oil under the Straight River just south of Park Rapids, if both projects are built, will be 175 percent of the entire early April flow of water under the river. (See Appendix 1.) The Straight River contains a nationally recognized brown trout fishery. Essentially, adding these two projects to this landscape enlarges and creates an industrial corridor through highly important natural resources and recreational areas.

I.E. Potential impacts during the 50 year project life with respect to pipeline leaks and ruptures, route comparison issues, Enbridge's historical record, and federal oversight.

The purpose of this part of the testimony is to describe why it is extremely important to consider pipeline leaks and ruptures in an EIS and in respect to route comparison and project location. It will also discuss Enbridge's record. This testimony reviews recent large and damaging pipeline events, including Enbridge's pipeline ruptures in 2010 and 2012, respectively in Michigan and Wisconsin. My testimony indicates that based on these recent events it appears that risk assessments of pipelines done since then have either concluded or implied that risks of large oil spill events are higher than previously thought. Such assessments are more cautious and express concern that human error—rather than engineering sophistication—is a major factor in ruptures and leaks. My testimony quotes from a finding of the National Transportation Board (NTSB) that Enbridge's management failures and the federal government's oversight failures contributed to the Michigan rupture of 20,000 barrels of oil into the Kalamazoo River. It includes studies directly relevant to the two Enbridge proposals and to comparing routes in Minnesota. This includes a study for the US Department of State that the potential impact zone that should be assessed for oil releases into waterways is at least 10 miles on either side of a proposed route. The testimony raises serious doubts that the Enbridge proposed route for both projects should be given a Certificate of Need under the conditions proposed by the Applicant. The testimony references and include extensive reports I submitted to the Department of Commerce in April during its Route Permit proceedings (Appendix 1 and 2).

I.F. Nature of pipeline construction that can cause impacts.

The purpose of this portion of the testimony is to describe the details of pipeline construction in order to relate it to impact assessment, permitting, route comparisons, and to understand Enbridge's environmental documentation and its limitations. Pipeline construction involves operations that have the potential for long term impacts. There are landscape differences that can significantly increase such impacts. My testimony describes pipeline construction techniques with a focus on the kinds of impacts that occur, including mitigation measures, and whether Minnesota agencies, if any, can make them mandatory requirements. It also provides a basis for developing methods of comparing routes based on this knowledge of impacts and whether one route is more problematic than another. The testimony includes as an Appendix a report I previously prepared on right of way requirements for large pipelines with a focus on potential impacts. (Appendix 3.)

I.G. Critique of Enbridge environmental documentation and impact assessment.

The purpose of this portion of the testimony is to determine the adequacy of Enbridge's environmental documentation of the most important and widespread potential impacts. This testimony demonstrates why the Enbridge documentation lacks an impact assessment on major topics related to the nature of pipeline construction, as identified in the previous section (I.E.). It points out that there is no discussion of operational impacts with respect to pipeline leaks and ruptures. The testimony indicates that often the Enbridge documentation describes possible mitigation measures, but, since there is little or no impact assessment preceding the description of the measures, one cannot determine sufficiency of those measures.

I.H. Description of the key elements of environmental review and of problems with the existing Minnesota decision making process for large diameter liquid pipelines.

The purpose of this portion of my testimony is to answer questions about the apparent procedural difficulties and problems with Enbridge's environmental documentation. Some citizens are certainly aware of these problems, as are agency staff who I have talked to. My testimony includes a description of how environmental review is conducted, since the administrative hearings on the Sandpiper proposal is not an environmental review process. I attempt to answer some questions as to why these problems exist. I discuss the difficulties of integrating the Minnesota Environmental Policy Act (MEPA) and its regulations into the PUC and Commerce procedures. This testimony reviews some of the problems with the three previous large pipelines constructed in Minnesota. It will compare these procedures with the normal environmental review procedures used on other types of large projects with respect to impact significance, and methods of analyzing impacts and comparing locations.

NOTE: Because of my desire to make my testimony easily accessible to readers who are not familiar with the PUC's traditional Q & A format, I have chosen to present the balance of my testimony in the narrative form of a report. For ease of identification for citation and examination purposes, I have retained the lined page format, and have put the report in outline form for easy reference to particular sections.

II. WHY ARE PIPELINE PROPOSALS IN MINNESOTA CONTROVERSIAL NOW COMPARED TO THE PAST?

Minnesota has more pipelines crossing it than many other states. This is partly because it lies between large Canadian production areas and Eastern and Central US industrial and population areas. Yet, until now, there has been little apparent public controversy when three large pipelines were recently constructed. These were the 24 inch Koch Industries MinnCan pipeline, the Enbridge 36 inch Alberta Clipper pipeline, and the 24 inch Enbridge Southern Lights pipeline. To the outside, public observer, there doesn't appear to have been much apparent concern from state agencies such as DNR and PCA on previous pipeline projects. The key word is "apparent" because, in fact construction of the three pipelines exposed problems with Minnesota's policy of studying and approving large pipelines.

The reasons for this large change also include other factors besides these three pipelines, and are highly relevant to the decisions of the PUC, as follows:

II.A. Recent large and damaging pipeline ruptures and leaks and role of human error. There have been large, disturbing and damaging recent pipeline accidents that have had human error and mismanagement as a cause or major contributing factor. Five such accidents are described in Section V below. Three of these were on Enbridge pipelines. These accidents have raised a high degree of concern in the public, in Congress, and in state legislatures.

II.B. "Corridor fatigue." This term is being commonly used among regulatory insiders. It describes how the addition of more and more pipelines (or other linear projects) in an existing utility corridor creates more and more conflicts. This is greatly exacerbated by the fact that the original corridors pre-date environmental laws. Therefore, they were established with little or no regard for environmental impacts. This topic is explored in Section V.I.D.2 below and in more detail in Appendix 1 and 2. In fact, this is one of the major factors explaining why the Sandpiper route along Enbridge's mainline corridor has been dropped from consideration.

II.C. Construction of three recent large pipelines in Minnesota exposed problems. The construction of Alberta Clipper, Southern Lights, and MinCann exposed major environmental impacts that were not addressed in permitting. For example, a number of comment letters from the DNR documenting impacts that were at least somewhat avoidable were not addressed by the ALJ or PUC and Commerce staff DNR, PCA, and Corps of Engineers staff familiar with these projects was well aware of these problems. (See also Appendix 1.)

One of the main problems was that DOC staff allowed the defective Enbridge-prepared CEA to be used without having an independent contractor prepare the studies. It also became clear in the DNR and PCA--during the review of these three pipelines—that it has been a fallacy to conclude that impacts from large-diameter pipelines are temporary and construction related. This is discussed in more detail in Sections VI- VIII below.

II.D. Public observations of the three large recent projects. The public was paying little attention to the recent three projects while they were in the permitting stage. However, during construction and especially in hilly areas outside of farm country, many members of the public observed the large size of the projects and became concerned. (For example, I retired from the DNR in 2009, but received calls from concerned citizens both before and after retirement.) In my opinion, at least some concerned members of the public have concluded that the Enbridge Mainline Corridor, and the proposed Sandpiper/Line 3 corridor, have become major linear industrial facilities through sensitive landscapes by lack of awareness by permitting authorites of what they have become.

III. PRACTICAL GUIDE TO ENVIRONMENTAL REVIEW (ER) AND PREPARATION OF REVIEWS OF LARGE PIPELINE PROJECTS.

III. A. Introduction: Why must decision makers understand ER?

In this section, I intend to explain the key elements that make up environmental review, as practiced under MEQB regulations, and that of other states and the federal government. My purpose is not to interpret ER law, or its regulations, but rather to explain how Minnesota

regulations are used to develop a proper impact assessment in general, and apply them to the Sandpiper/Line 3 projects in particular.

Key users of ER are not usually technical people. In my view, decision makers should understand environmental review in plainer English that the regulations provide. Over time, ER practices have become cumbersome, bureaucratic, and confusing. And many people think that ER is a only hoop to jump through of little substance. This is unfortunate, because the lawmakers who passed the laws that are the foundation of ER did not have this intent.

Basically, the intent of ER is simple: it is a founded in a "sunshine law" whose purpose is to shed light on the consequences of our societal activities that affect the environment—before we take these actions, and in time to change them should the consequences be serious and avoidable. It is also the intent of this law and its regulations to allow and encourage the public to be part of such decisions.

It is especially important to understand how conclusions about potential project impacts are defined. This is because a possible outcome of the necessary ER studies could be that the PUC would deny a Certificate of Need (CN) for this proposed route because it demonstrates unacceptable risk and unacceptable impacts to Minnesota resources, while at the same time indicating to Enbridge they should seek a less impactful corridor for these two additional lines.

There is also a large difference in how ER relates to linear projects as compared to projects proposed for one site. By their nature of being linear, moving the route to avoid a problem in one area can result in affecting another problem area. This complicates individual permitting and the analysis of impacts. It is also a big mistake to conclude that linear *pipeline* projects should be handled with the same policies as linear high voltage transmission line projects.

In point of fact, decisions on large and long linear *pipeline* projects, when proposed in environmentally sensitive areas, and coupled with a large degree of public concern, *should* always be difficult for government agencies as well as for the project proposer. This is because deciding to approve them in such locations should require a high bar of proving they will not cause disastrous impacts should they fail, and that they meet a high bar for quality of studies. And such pipeline projects are only very superficially like the regulated utility High voltage Power Line projects the PUC is familiar with. They cross many jurisdictions and potentially affect many people just as do power lines. But pipeline projects carry a much higher potential for long term damage to natural resources and people. They also attract legitimate concern from outside residents who recreate in these areas, or hold them dear for their intrinsic value. .

III.B. What is "environmental review?"

III.B.1. What is the purpose of ER? "Environmental review", at its simplest, is the concept of attempting to *objectively* understand the consequences of building something *before* it is built. If done correctly, the understanding of consequences should occur in time to change *what* is planned, or, at least as importantly, to *change the location* of what is planned in order to *reduce* the social, economic, and environmental consequences when such actions are found to

potentially cause *significant adverse effects*. My testimony primarily focuses on the highlighted words in these sentences.

III.B.2 When did ER begin, and why? The federal environmental review law was passed in 1969, and Minnesota's own law was passed in 1973. It was modelled on the federal law. This was part of the flurry of environmental laws passed in the 1960's and 1970s. There was bipartisan support for the laws; for example, the Clean Air Act was signed by Richard Nixon. What led up to passage was increased understanding of the environment coupled with understanding of how we were affecting the environment. The sustained period of economic expansion and building that had occurred after WWII also led to people noticing some of the negative impacts of uncontrolled growth.

But this was also coupled with something very important: A realization that adjustments could be made in *how* we built projects or *where* we built them so that damage to the environment could be reduced, sometimes at very little cost, or even less cost. This was the foundation for the passage of the federal and state ER laws.

III.B.3. Why is this history relevant to Sandpiper and the Line #3 replacement? The Enbridge mainline corridor, and the Sandpiper route south of Clearbrook to the Park Rapids area, was established *before most Minnesota or federal environmental laws were passed*. In many cases the first pipelines were built in nearly a straight line without regard to environmental features. In other words, these first pipelines created corridors where none would have been placed under current understanding of impacts and under current law and policy.

III.C. How does ER relate to environmental permits? ER documents are crucially important to permits, and ER law and regulation connect these closely. Here are some major points:

1. The ER analysis applies to the whole project, while most environmental permits apply to specific impacts and aspects of a project, such as waste discharges.

2. The ER analysis is to identify all significant impacts, whether there are permits for them or not. For example, analysis of the Sandpiper/Line 3 projects may identify large acreages of topsoil loss due to mixing with parent material, but there is no permit for this, nor are there specific permits regarding general wildlife habitat losses, even though hundreds of acres are involved. (Note: ER documents also often name many impacts but note they are not significant.)

3. ER documents themselves don't mandate actions—except as noted in Section III.E.9 and III.E.13 below—but may reveal information that results in mandatory changes in a project.

4. ER documents must identify all project permits, and do develop information relevant to permits. This helps provide permit information to other agencies, and also helps ER document preparers focus on relevant information for permits. Mitigation measures developed during ER document preparation can be incorporated into permits.

5. No Minnesota government entity can issue environmental permits before completion of environmental review. However, agencies can begin processing permits during the review.

6. Federal permits trigger federal ER. Some overlap between federal and state information requirements is common. The Clean Water Act, triggered by some state and federal permits, have requirements for demonstration that there is not a reasonable alternative available with fewer impacts.

III.D. What are the key elements of environmental review?

The following are key elements of both federal and state ER laws and regulations. Also, I have tried to focus on elements that are especially appropriate for these two pipeline projects. One may use them as guidance to judge whether ER on the two Enbridge projects is successful or deficient.

III.D. 1. Types of documents and studies. The "depth" of studies for ER documents is based on the project's physical magnitude and possible magnitude of impacts. In Minnesota, there are two kinds of studies: An Environmental Assessment Worksheet (EAW) and an Environmental Impact Statement (EIS.) The EIS is an-in-depth study. Generally, the main purpose of an EAW is to determine whether an EIS should be done. As a practical matter, many EAWs are done and fewer EISs are done. The EAW without an EIS often functions as an information document for the public and agencies, and, importantly, as a tool for identifying mitigation to reduce impacts. (Note for clarity: In *federal* law, the first stage of ER is the preparation of an Environmental Assessment (EA) which is normally more comprehensive than Minnesota's EAW.)

Both kinds of Minnesota reviews are specifically defined and explained in regulations and by rule. The MEQB also publishes in-depth guidance documents for use by the public and project proposers.

III.D.2. Who prepares ER documents and what are their qualifications? In Minnesota, government agencies are always responsible for the ultimate content of ER documents. Here, they are called the "Responsible Governmental Unit, "or RGU. Sometimes government employees prepare the document—especially when their own projects trigger ER. But most often, document preparers are government officials who have relied on applicant's environmental reports. But it is uncommon for an RGU to rely on the applicant's environmental reports on big projects.

Document preparers vary from those with technical training to those with little or no technical training. The latter have usually have received on-the-job training in "apprentice" positions with consulting firms or state agencies. They obtain their ability to prepare such documents by examining previously prepared ER documents or by working under technical people. The most common technical background of individuals who prepare or supervise the preparation of ER documents in Minnesota is engineering, in my opinion.

It is common for project developers to hire a consultant to prepare their own initial ER documents, and also quite common for the government agencies to rely on such documents.

III.D.3. Quality control of ER documents. There has been an inherent and chronic conflict of interest when project proposers preparing their own ER documents conclude it is best to

downplay or ignore serious impacts that raise costs. As a result, over time, there has been more and more guidance from the MEQB on this topic. MEQB has stressed that it is the responsibility of the government agency (RGU in Minnesota) to detect such problems. And they have stressed that applicants should supply data in their ER documents, rather than conclusions and analysis. The potential for conflict of interest is also why outside reviews of draft ER documents are so important.

Unfortunately, quality of content unrelated to conflicts of interest is still a problem for many ER documents, even EISs. For example, even after many years of ER, one commonly finds statements that wildlife species will move from a project area to another area and thus such an impact is a temporary impact. This is scientifically erroneous: wildlife populations are a function of habitat size; habitat acreage loss means permanent population reduction.

III.D.4. <u>Timelines and due process for project developers</u>. All ER regulations have concrete and mostly mandatory timelines covering when documents are due, and include deadlines for public comments. With justification, persons proposing and building projects are concerned with lack of clarity in how reviews are conducted by government, public involvement, and potential delays. In my opinion, this was a trade-off that occurred when the laws were passed. Those wanting thorough reviews got some assurance it would occur, while project proposers got assurance of due process via such deadlines.

There are deadlines for commenting on EAWs, draft EISs, and Final EISs. The final step is the Record of Decision prepared by the RGU.

III.E.5. <u>Scientifically based objective analysis</u>. Environmental review is intended to be based on sound scientific data and analysis. The intent of the process is to identify relevant studies suitable for defining impacts as much as possible. This includes using environmental reviews of other similar projects that have already been completed as a source of technical information. However, in another sense, ER documents are not fully scientific documents either, since they extrapolate data to conclusions that otherwise might not be reached in a scientific forum: *because government agencies must make decisions even when information is not complete*. It is particularly important in such situations for government agencies other than the RGU, the public, the applicant, and other affected parties to review ER documents in these subjective situations.

ER documents can look thorough and complete to non-technical people simply because the content is technical. This doesn't mean it's a quality ER document. Also, when the ER document is an EIS, conclusions about different topics of analysis in the EIS need to be judged by the standards of the topic rather than one standard. For example, the standards of "proof" for engineering topics are different than the standards for drawing ecological conclusions. This is because ecological systems are not understood as completely as engineering topics but government permitting agencies—and those preparing ER documents—must still draw conclusions.

III.D.6. <u>Public review of an EAW and draft EIS documents</u>. Both federal and state ER laws have, as a foundation principle, the clear requirement for the public (and any other entity) to

review and comment on the EAW (or federal EA), and then the draft and final EIS. Furthermore, the responsible government agency *must* respond to substantive comments on these documents.

III.D.7. Ease of public participation. Both federal and state ER laws and regulations make it easy for the public to understand and participate in the review process. A major purpose is to provide a democratic process understandable to engaged members of the public. Even those who have difficulty with bureaucratic procedures can usually participate. In Minnesota, the MEQB provides helpful and detailed guidance manuals describing the process and the role of citizens.

ER documents are also intended to invite public participation in agency decisions, and function to provide both technical and public opinions on the more subjective parts of decisions on issuance of controversial permits. Furthermore, in my experience, the public comes up with technical issues missed by document preparers because they often know more about local landscapes.

III.D.8. Defining a project, its operations, and its operation life. This is a crucial first step that must be taken prior to proceeding with an analysis of impacts and comparison of alternatives. It is also a frequent defect in project documentation. It is crucial because if a project's "environmental footprint "is not clearly defined or known, one can't properly determine impacts or mitigation measures. This is a major problem with Enbridge's environmental documentation, as described in Section VII. (See also the discussion about "related actions" in Section IV.B and C.)

For projects such as both of Enbridge's proposals, analyzing possible impacts during the *operation* of the pipelines is very important, as discussed in Section V. A project life of 50 years is often used for projects that have a long operational time frame. I have used it in this testimony for the sake of discussion, but none of my conclusions require a specific future number.

III.D.9. Scoping of issues. This concept is used to select the most important issues for further analysis, such as in an EIS, in order to avoid including extraneous material. Again, this is a participatory process. Therefore, an agency intending to prepare an EIS first publishes a Scoping EAW, which lays out intensions for the detailed analysis so the public can weigh in with its views. The scoping concept was developed to counter problem of voluminous ER documents containing information that wasn't used.

III.D.10. Analysis of alternatives EIS document preparers are required to do a careful analysis of alternatives to a project. Furthermore, the state policy from the Minnesota Environmental Policy Act (MEPA) says that no state permits shall be issued for a project that has serious impacts if there is an alternative with fewer impacts, and that economic considerations alone can't be the determining factor. This is based on an important provision of MEPA: "*Subd. 6.Prohibitions. No state action significantly affecting the quality of the environment shall be allowed, nor shall any permit for natural resources management and development be granted, where such action or permit has caused or is likely to cause pollution, impairment, or destruction of the air, water, land or other natural resources located within the state, so long as there is a feasible and prudent alternative consistent with the reasonable requirements of the*

public health, safety, and welfare and the state's paramount concern for the protection of its air, water, land and other natural resources from pollution, impairment, or destruction. Economic considerations alone shall not justify such conduct." (Emphasis added.)

This clause in Minnesota ER law is well known to government agencies that are familiar with EIS preparation.

III.D.11. Permanent vs temporary impacts. Generally speaking, in environmental review there is an important and somewhat subjective distinction between temporary and permanent impacts. Temporary impacts are considered of much lower importance than permanent impacts. The problem is that project developers often claim temporary impacts when, upon careful examination, there are in fact long-term important impacts.

III.D.12. Role of government agencies other than the agency preparing the ER review. In many instances, other agencies have more significant environmental permits than the RGU that has been designated in the rules. Other agencies often also have more expertise concerning the potential impacts to the environment than does the RGU. This is the case with the PUC and Department of Commerce with respect to pipelines, since they have small staffs primarily functioning as coordinators. Therefore, state agency roles in commenting on ER documents are very important. This also lets applicants know of concerns as early as possible regarding permits.

In Minnesota, it is rare for a single agency to have an overall project permit for a complex project with many individual government permits. The pipeline routing permit administered by the Department of Commerce and PUC is therefore unusual.

In fact, the MEPA law specifically sets out a number of roles of Minnesota agencies having environmental permits and general responsibilities for environmental issues. These include coordinating with other agencies, representation on the MEQB, and staff assignments to the MEQB.

III.D.13. Analyzing related actions and projects in the same or adjacent location. In order to accomplish an adequate impact analysis, the EIS must address other planned projects in certain circumstances. As described in Section IV, Enbridge's plans to build the Line 3 replacement in the same corridor as Sandpiper apparently meet this requirement. In addition, the cumulative impacts of past projects in the existing corridors also need to be addressed.

III.D. 14. Mandatory mitigation measures. In ER preparation, identification of mitigation measures may become an important part of the project, and, in practice, sometimes become mandatory. They can be identified and made a requirement of various permits, or they can become incorporated into the project during the ER study phase. This is essentially a change in the project. An example of the latter mitigation is if Enbridge were to commit to moving the pipeline location to avoid a sensitive area, or to cross a river at a more appropriate location because of ER findings.

IV. WHY WOULD AN EIS BE NORMAL GOOD PRACTICE FOR THE CERTIFICATE OF NEED FOR SANDPIPER/LINE 3?

As a person tasked with making recommendations as to whether an EIS is needed—a role I have been in during my career—I would recommend an EIS for the Enbridge projects based especially on information in this Section of my testimony. When considering decisions as to whether an EIS is needed, the staff of government agencies assigned to address ER is well aware of the overall policy standard for determining an EIS is needed: it is needed "when there is a potential for significant environmental effects." (See IV.C for a summary about this policy.)

No one has determined that pipelines, especially the CN decision, do not need to fulfill the requirements of the Minnesota Environmental Policy Act. There is no specific statements in CN rules that describe the type of ER document that should be prepared in order to address the CN criteria pertaining to the environment and alternatives decision that must be made in the CN decision. However, there is helpful guidance in the MEQB rules and law that can be used to support findings that an EIS is needed on the Certificate of Need. Furthermore, the clearest foundation are the undisputed facts that Sandpiper/Line 3 constitutes projects of very large physical magnitude, and potentially very damaging operational impacts should the pipelines rupture during a 50 year project lifetime, if built on the proposed route. Conducting an EIS by Minnesota agencies is the proper response to these circumstances.

There are three other facts about Sandpiper/Line 3—aside from the above quoted state policy about significant environmental effects—that are essentially guidance for concluding that an EIS on the two Enbridge projects would be normal practice:

1) That of the project's physical and operational magnitude when compared to the magnitude of other projects for which an EIS is required and that contain specific physical project size with the Sandpiper/Line 3 physical size.

2) Rules pertaining to related projects in essentially the same location (See IV.B.), and

3) The fact that Wisconsin is preparing an EIS on both projects together for its portion of the projects, and Enbridge has in fact indicated it wants to build both projects at the same time. It could well be that Enbridge will respond to a question as to why they haven't proposed this in Minnesota by saying that such joint construction is not in their plan for various reasons, and is therefore a different project. This is in effect saying that unknown factors trump environmental protection, since joint construction can result in reduced impacts. To me, such a statement would not be supported in normal ER decision making for projects, since there are clear environmental benefits of constructing together, if attainable precautions are taken.

MEQB rules provide guidance on these topics that could or must be applied to decisions about Sandpiper and the Line 3 replacement projects, as follows:

IV.A. Project magnitude. There are mandatory EIS categories—projects for which an EIS must be prepared—for projects based on the physical magnitude of the project. These can be

compared to the size of the Enbridge projects. According to Enbridge, permanent forest loss is 619 acres, and temporary forest lost will be 1,524 acres for Sandpiper alone.

Now compare the size of other types of projects that require an EIS in order to gain perspective on the magnitude of the Enbridge projects. MEQB rules say the following, with the underlining being my emphasis on what to compare with permanent impacts of the Enbridge projects:

"*Mandatory EIS categories:*

*Subpart 1. Threshold test. An EIS must be prepared for projects that meet or exceed the threshold of any of subparts 2 to 25. Multiple projects and multiple stages of a single project that are connected actions or phased actions must be considered in total when comparing the project or projects to the thresholds of this part. (*Author's note: Of course, there are as yet no figures for Line 3 impacts.*)*

"Subp. 9. Nonmetallic mineral mining. . . .

"A. For development of a facility for the extraction or mining of peat which will utilize 320 acres of land or more during its existence. . . .

"B. For development of a facility for the extraction or mining of sand, gravel, stone, or other nonmetallic minerals, other than peat, which will excavate 160 acres of land or more to a mean depth of ten feet or more during its existence, ...

"C. For development of a facility for the extraction or mining of sand, gravel, stone, or other nonmetallic minerals, other than peat, which will excavate 40 or more acres of forested or other naturally vegetated land in a sensitive shoreland area or 80 or more acres of forested or other naturally vegetated land in a nonsensitive shoreland area, . . .

"*Subp. 16. Highway projects. For construction of a road on a new location which is four or more lanes in width and two or more miles in length, ...*

"Subp. 27. Land conversion in shorelands. For a project that permanently converts 40 or more acres of forested or other naturally vegetated land in a sensitive shoreland area or 80 or more acres of forested or other naturally vegetated land in a nonsensitive shoreland area, ...

"Subp. 20. Wetlands and public waters. For projects that will eliminate a public water or public waters wetland, ...

"Subp. 15. Airport runway projects. For construction of a paved and lighted airport runway of 5,000 feet of length or greater, . . ."

IV.B. Related actions, connected actions, phased actions, and cumulative impacts of projects. MEQB rules and guidance documents directly consider in multiple ways the situation posed by Enbridge's plans to put the replacement Line 3 mostly in the same corridor as

Sandpiper and within a few feet of it. Consider the following rules, with my emphasis and notes added into the quoted text:

"Subp. 11a. Cumulative potential effects. "Cumulative potential effects" means the effect on the environment that results from the incremental effects of a project in addition to other projects in the environmentally relevant area that might reasonably be expected to affect the same environmental resources, including future projects actually planned or for which a basis of expectation has been laid, regardless of what person undertakes the other projects or what jurisdictions have authority over the projects. Significant cumulative potential effects can result from individually minor projects taking place over a period of time. In analyzing the contributions of past projects to cumulative potential effects, it is sufficient to consider the current aggregate effects of past actions. (Author's note: This means that "corridor fatigue" issues need to be fully examined in the environmental analysis and in the comparison of routes.)

"Subp. 9c. Connected actions. Two projects are "connected actions" if a responsible governmental unit determines they are related in any of the following ways:
*A. one project would directly induce the other;" (*Authors note: Enbridge has explicitly said it will put the 36 inch Line 3 replacement in the Sandpiper corridor to take advantage of its presence; essentially this is quite explicitly saying Sandpiper induces Line 3.)

"Subp. 60. Phased action. "Phased action" means two or more projects to be undertaken by the same proposer that a RGU determines:
A. will have environmental effects on the same geographic area; and
B. are substantially certain to be undertaken sequentially over a limited period of time."
(Author's note: Line 3 will be placed alongside Sandpiper, and Enbridge has indicated in public announcements that it expects permitting will take "about a year.")

"*Subp. 4. Connected actions and phased actions. Multiple projects and multiple stages of a single project that are connected actions or phased actions must be considered in total when determining the need for an EIS and in preparing the EIS. " (*Author's note: No matter what the extent of the analysis of the impacts of Line 3, the future presence of Line 3 certainly increases the magnitude of impact. Impact magnitude is what triggers the necessity of an EIS.)

*"Subp. 5. Related actions EIS. An RGU may prepare a single EIS for independent projects with potential cumulative environmental impacts on the same geographic area if the RGU determines that review can be accomplished in a more effective or efficient manner through a related actions EIS. A project must not be included in a related actions EIS if its inclusion would unreasonably delay review of the project compared to review of the project through an independent EIS." (*Author's note: This rule provides some limited flexibility for the PUC to manage the actual impact assessment of Line 3; however, given the overwhelming evidence that an EIS is needed for Sandpiper, it is doubtful there will be an unreasonable delay caused by including Line 3 in the analysis.)

IV. C. Conclusions regarding Sandpiper/Line 3 regarding the standard for preparing an EIS. As noted above, government officials tasked with making determinations as to whether an

EIS is needed, must use, by law, a determination as to whether a project "has the potential for significant environmental effects." If the answer is yes, an EIS is indicated.

The above quoted rules and guidance, and other parts of my testimony, support the following four conclusions:

1) Enbridge's Sandpiper/Line 3 project's geographic scope—its "environmental footprint"—is far larger than all other mandatory EIS categories that are based on acreage or length impacts, and

2) Sandpiper/Line 3 replacement must be addressed together with respect to cumulative impacts and the decision as to whether an EIS must be done, even though they are separate projects in other ways. The projects are likely to be proposed to be constructed only about 50 feet apart, based on plans in Wisconsin.

3) Enbridge's environmental documentation in its applications doesn't cover important construction and land requirement impacts adequately and is silent of operation impacts; therefore, is also silent on mitigation of impacts because the impacts are unknown but potentially significant.

4) Operation during an approximately 50 year project life has the potential for exceptionally significant environmental effects. This is discussed in more detail in the next section and in Appendix 1 and 2.

V. POTENTIAL OPERATION IMPACTS OVER APPROXIMATELY 50 YEAR OPERATION WITH FOCUS ON PIPELINE ACCIDENTS, LEAKS AND RUPTURES AND POTENTIAL ENSUING CONSEQUENCES

V.A. Introduction. As noted earlier in this report, the two Enbridge proposals are very large projects proposed to carry very large volumes of oil. For example, if they are constructed as proposed, the petroleum product flow under the Straight River just south of Park Rapids — including volatile Bakken oil and heavy crude Tar Sand oil—will be about 175 percent of the Straight River early April water flow. (See Appendix 1.)

These pipelines, if constructed, will be in place for at least 50 years in highly sensitive environments. Even with the best possible management oversight and training, operators get complacent as time goes by and there are no accidents. There are other high-tech situations that are comparable. Take, for example, the troubling scandal involving US Air Force crews manning nuclear missiles. According to news reports, it was found that all sorts of rules were being broken and covered up—the apparent cause being boredom and no real actions except training exercises.

Pipeline systems are technologically complex in order to transport the large quantities of liquid petroleum product they carry. They are much more than a pipe in the ground. There are complex control and monitoring systems to detect pressure changes and ruptures, and systems to shut down operation of the lines should there be a rupture. There are also detailed records of

pipe manufacture, and installation—such as for welds during construction. Also, there are highly technical methods of monitoring the pipeline after installation to find such things as corrosion or damage.

And, just like many other high technology systems, if there is failure, the consequences are environmental damage and risks to people. There are clear tools available for decision makers to assess the likelihood of failure and environmental consequences of failure. These tools aid in decisions regarding locations for the pipeline, and aid in engineering decisions to add extra technological features. For example for pipelines, additional site specific risk assessment can result in additional automatic shutdown values.

The decision and assessment tool of most interest in the EIS review of Sandpiper/Line 3 is risk assessment coupled with specific requirements to yield findings relevant to impacts to natural resources and comparison of routes. There are a number of such risk assessments already accomplished that are applicable to these projects as discussed in this testimony. A central point of risk assessments—a *foundation principle of assessing risk—is that when there are large adverse consequences, the rare and even unlikely events need to be incorporated into the analysis.* In fact, if such rare events are not included, at least in formal risk assessment, it is not considered a valid exercise. This is a general principle applicable to risk assessments done for many technologies besides pipelines.

In the following sections, I will:

V.B Describe some of the recent pipeline incidents that have brought a large amount of attention to the whole issue of failure of pipelines and human error contributing to such failures,

V.C. Describe recent concerns from the NTSB and others about the capability of the federal government to adequately supervise pipeline safety.

V.D. Describe other studies and risk assessments relevant to showing that the Sandpiper/Line 3 proposed route is a very poor location for these projects, and that point to highly important topics to be addressed in an EIS, and

V.E. Draw conclusions as to the significance of these issues to studying alternatives and the potential damage to Minnesota's resources.

V. B. Recent large and damaging pipeline ruptures and leaks and role of human error.
One of the reasons for the high public attention given to pipelines lately is that large and damaging pipeline accidents have recently occurred. This has happened in spite of continued advances in pipeline technology and oversight by the federal Office of Pipeline Safety.

Investigation of the recent large pipeline events have found human error and mismanagement as a cause or major factor contributing to much higher damage. Human error is more difficult to prevent and to forecast in risk assessments as compared to clear-cut engineering solutions that reduce risk. This is especially true when considering that pipeline engineering, including heightened ability to detect corrosion and other problems, continues to improve. Pipeline safety

regulations also supposedly have been steadily improving. And yet evidence suggests that human error and mismanagement of pipeline information may not be improving. This should definitely be a topic of analysis in an EIS.

In addition, these accidents have resulted in major questioning of the adequacy of the Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations. This is a federal oversight agency located within the US Department Transportation.

The recent pipeline accident events include five recent events that are described herein. Three of them involve Enbridge pipelines. The natural gas pipeline explosion is included because the gross mismanagement of a failing pipeline in a residential area occurred in spite of major safety requirements. It has contributed to public attention on *any* pipeline, including those in Minnesota, because it was such an egregious violation of rules supervision of safe pipeline operation. (Note: There have been other recent events not included here.)

Collectively, these events have led to a number of recent and important risk assessments, PHSMA activities, and Congressional attention highly relevant to the EIS on Sandpiper/Line 3, including reasons to additionally question the proposed route, and comparison of alternatives. These events also have indicated that Minnesota should take a much more active role in analyzing risk, mitigation of risk, and state oversight of pipelines.

V.B.1. Enbridge pipeline rupture into Talmadge Creek and the Kalamazoo River in Michigan. Approximately 20,000 barrels of oil were released in 2010 from a 30-inch diameter pipeline. The ongoing cost for clean-up recently reached $1.21 billion, according to recent Enbridge securities filings as reported by the press (See Appendix 7). This is substantially higher than previously estimated, and Enbridge expects cost to continue to rise. Pipeline operators failed to shut down the pipeline for 17 hours after the rupture occurred, and in fact tried to twice re-start the pipeline pumping. This is tar sand oil. The lighter elements vaporized, and the heavy oil portions are in river sediments. Impacts occurred at least 35 miles downstream from the release. (See also V.C. below and also Appendix 1.)

V.B.2. Two Enbridge pipeline failures of Line 14 in Wisconsin. The following information about these failures can be found in two corrective action orders of the federal PHMSA Office of Pipeline Safety, dated July 30 and August 1, 2012. (See Appendix 5 and 6.) This 24-inch pipeline, running from Superior Wisconsin to Mokena, Illinois failed by seam rupture in two locations, first in 2007, then again in July 2012. Amounts of oil released were, respectively, 1,500 barrels and 1,200 barrels of product in the two locations. Enbridge rapidly responded to the 2012 release, and shut down the pipeline in about 17 minutes after the leak was detected. However, this pipeline, installed in 1998, had a significant history of seam failure and that during construction, ". . . radiography of girth welds revealed lack-of-fusion defects in the ERW seams at multiple locations along the Affected Pipeline." (emphasis added.)

The 2012 failure happened two years after the very large Kalamazoo River Michigan event. PHMSA found that, ".. . . .additional failures throughout all parts of the Lakehead System indicate that Respondent's (Enbridge) integrity management program may be inadequate." (emphasis added.) The additional 2012 failure in Line 14—coming two years after the very large

Michigan event and after Enbridge assurances of management changes—appears to have been a last straw. PHMSA ordered a detailed review of the entire Lakehead System, including the hiring of an independent outside reviewer, and a commitment by Enbridge to these details, before it allowed a re-start of Line 14 (emphasis added. See August 1, 2012 Amendment to the July 30 Order, Appendix 6.)

V.B.3. ExxonMobil Pipeline company rupture under the bed of the Yellowstone River. This accident was about 20 miles upstream of Billings, Montana. It was caused by scour from flooding that exposed and fractured the 12-inch pipeline that was trenched under the river bed. An estimated 1,509 barrels of oil were released before the pipeline was closed in 2011. The slowness of the shut-down significantly contributed to the amount released. Clean-up and recovery costs were $135 million. (Recent news reports indicate final costs and fines are not yet resolved.)

V.B.4. 2010 San Bruno natural gas pipeline explosion. While this event happened with a natural gas pipeline, the massive management failures of the Pacific Gas and Electric Company were a foundation cause of this event. It also revealed failures of government agencies, such as the Federal Department of Transportation and PHSMA, to provide adequate oversight. That is clearly why this event is relevant to the Sandpiper/Line 3 project—*since it implies that Minnesota cannot necessarily rely on the federal government to adequately provide oversight on these projects or determine the scope of studies of potential damages*.
This event occurred on Sept 9, 2010 in this suburb of San Francisco. A 30-inch (76 cm) diameter steel pipeline exploded in a residential neighborhood. It took crews nearly an hour to determine it was a gas pipeline explosion. As of September 29, 2010, the death toll was eight people. Eyewitnesses reported the initial blast caused a wall of fire more than 1,000 feet high.

This event is also discussed in Appendix 1.

The fallout from this accident continues to this day. There is much information available online about the accident and the fallout, including technical information. The Wikipedia entry provides a succinct statement of recent developments: "*On April 1, 2014, PG&E was indicted by a federal grand jury in U.S. District Court, San Francisco, for multiple violations of the Natural Gas Pipeline Safety Act of 1968 relating to its record keeping and pipeline "integrity management" practices.. . . An additional indictment was issued by the grand jury on July 29, 2014, charging the company with obstruction of justice for lying to the NTSB regarding its pipeline testing policy, bringing the total number of counts in the indictment to 28.. . .Under the new indictment, the company could be fined as much as $1.3 billion, based on profit associated with the alleged misconduct, in addition to $2.5 billion for state regulatory violations*."

V.C. Concerns about the capability of the federal government to adequately supervise pipeline safety.

The National Transportation Safety Board investigated the Enbridge Michigan spill described above. It made a finding in 2012 concerning inadequacies of Enbridge and at the Pipeline and Hazardous Materials Safety Administration. The following is a direct quote about their findings:

"*Executive Summary*

"On Sunday, July 25, 2010, at 5:58 p.m., eastern daylight time, a segment of a 30-inch-diameter pipeline (Line 6B), owned and operated by Enbridge Incorporated (Enbridge) ruptured in a wetland in Marshall, Michigan. The rupture occurred during the last stages of a planned shutdown and was not discovered or addressed for over 17 hours. During the time lapse, Enbridge twice pumped additional oil (81 percent of the total release) into Line 6B during two startups; the total release was estimated to be 843,444 gallons of crude oil. The oil saturated the surrounding wetlands and flowed into the Talmadge Creek and the Kalamazoo River. Local residents self-evacuated from their houses, and the environment was negatively affected.

"Probable Cause

"The National Transportation Safety Board (NTSB) determines that the probable cause of the pipeline rupture was corrosion fatigue cracks that grew and coalesced from crack and corrosion defects under disbonded polyethylene tape coating, producing a substantial crude oil release that went undetected by the control center for over 17 hours. The rupture and prolonged release were made possible by pervasive organizational failures at Enbridge Incorporated (Enbridge) that included the following:

"--Deficient integrity management procedures, which allowed well-documented crack defects in corroded areas to propagate until the pipeline failed.

"--Inadequate training of control center personnel, which allowed the rupture to remain undetected for 17 hours and through two startups of the pipeline.

"--Insufficient public awareness and education, which allowed the release to continue for nearly 14 hours after the first notification of an odor to local emergency response agencies.

"--Contributing to the accident was the Pipeline and Hazardous Materials Safety Administration's (PHMSA) weak regulation for assessing and repairing crack indications, as well as PHMSA's ineffective oversight of pipeline integrity management programs, control center procedures, and public awareness. (Emphasis added.)

"--Contributing to the severity of the environmental consequences were (1) Enbridge's failure to identify and ensure the availability of well-trained emergency responders with sufficient response resources, (2) PHMSA's <u>lack of regulatory guidance</u> for pipeline facility response planning, and (3) <u>PHMSA's</u> limited oversight of pipeline emergency preparedness that led to the <u>approval of a deficient facility response plan</u>." (Emphasis added. July 10, 2012. Executive Summary of National Transportation Safety Board. NTSB Number: PAR-12-01 NTIS Number: PB2012-916501)

V.D. <u>Other studies and risk assessments relevant to showing that the Sandpiper/Line 3 proposed route is a very poor location for these projects</u>.

Other recent EIS studies on other projects, as well as risk assessments (and related studies) that appear to be relevant to the Sandpiper/Line 3 projects are appropriately looked at when conducting accepted practices of scoping an EIS topic. I have located several of these documents that are highly appropriate to the proposed projects.

As noted above, there has been a flurry of government activity regarding pipeline failures and the large environmental and economic consequences of these failures. I summarized five of the events and the investigations of them in the above section. (There have been other recent serious pipeline accidents as well.) There have been a number of recent major risk assessments that also are very relevant to an EIS on Sandpiper/Line 3, its route, and route comparisons, including the system alternatives now being studied by the DOC.

In this section, I include recent risk assessment-related documentation relevant to the proposed route and its projects. All of these studies came after the large pipeline rupture events included in my testimony, and after findings that human error was a major factor in the events.

V.D. 1. ORNL shutoff valve risk assessment This detailed study covered both gas and liquid pipeline ruptures, and used modelling to predict damages and releases. It compared modelling results to the Enbridge Michigan event, among others. It was reviewed in some detail in my comments to the DOC, which is Appendix 1 in my testimony. I am incorporating this material into my testimony. It has direct relevance to the Sandpiper/Line 3 project and proposed route in a number of ways, including, but not limited to the following two points:

a. It can be used in an EIS to look at consequences on proposed and different routes. It addresses the consequences of large events like the Michigan Enbridge event, including estimates of costs, extent of damage, etc. It also discusses scenarios of ruptures without ignition accompanying the rupture, and then with ignition and fire after the rupture. In fact, the Enbridge Michigan event is used in the ORNL report as a case study. As I point out in Appendix 1, however, the scenarios addressed do not include whether fires will damage adjacent pipelines that are a few feet away, such found in the corridor proposed by Enbridge.

b. Recommendations for additional automatic valve locations. The recommendations in the ORNL study indicate additional automatic valves should be included based on such things as landscape conditions. The question is, has this been specifically done for the Enbridge projects, and exactly where are they located? In addition, there will be route differences as to the need for such additional features, which can be used as an indicator of the sensitivity of the route.

V.D.2. "Third-Party Consultant Environmental Review of the TransCanada Keystone XL Pipeline Risk Assessment." Prepared by the Exponent Consulting Company.

This April 2013 study was prepared for the US Department of State and TransCanada Keystone Pipeline. (The US Department of State is responsible for the federal EIS on Keystone.) The analysis is not a risk assessment per se, but rather an environmental review critique of the previous risk assessment done in 2009 for the Keystone EIS. (Note: That risk assessment was finished before the large Enbridge Michigan event and other relevant serious events.) The report

notes that the above-cited ORNL study engineering study on automatic block valve placement was the other report prepared to update the 2009 risk assessment.

This study contains findings of major significance to conducting an adequate analysis of impact from the Sandpiper/Line 3 projects, and on the route comparison. I will not go into all of the relevant points; however, I am including some directly pertinent to the projects in Minnesota. In fact, they are likely more pertinent than along the Keystone Route because of the higher levels of surface and groundwater, and complicated moraine landscape found along the proposed route in Minnesota.

The purpose of the report is worth quoting because of its relevance to the purpose of the review of the Enbridge proposals in Minnesota. The following language is in the Report summary and the introduction:

" *This final report summarizes the results of work performed by Exponent representing the "Environmental Review" of the Keystone XL Project Risk Assessment (Appendix P of FEIS) and related sections in the Final Environmental Impact Statement (FEIS). This work represents a limited and directed scope of review focused specifically on the Risk Assessment (Appendix P of FEIS) and on specific questions addressed to Exponent. . . . .The agencies thought it advisable to have an additional environmental review of the Risk Assessment because of the highly technical nature of the issues involved, and the desire to ensure that the Project-specific Special Conditions are properly implemented in the event that a Presidential Permit is issued. To address the issues identified by the agencies, we relied on information in the Risk Assessment and FEIS as well as information we obtained that related to the issues identified by the agencies. . . . . .Exponent was tasked by the agencies to provide the environmental review, part of which was to consider the presence of other sensitive environmental resources along the Project that may warrant additional environmental protection. These potentially sensitive environmental resources were in addition to those that had been the focus of the Risk Assessment."*

Given some of the wording of this report, its content is influenced by the recent damaging pipeline events that occurred after the original 2009 EIS study for Keystone XL. The study notes that a number of impact issues have not yet been addressed in the Keystone EIS, but are rather waiting on final centerline selection. These issues are also relevant to the Enbridge impact assessment and route comparison. Here are some Exponent findings directly relevant to the Sandpiper/Line 3 projects, the proposed route, and comparison of system alternatives:

V.D.2. a. **<u>Analysis of risks related to small stream crossings.</u>** Small streams were defined in this study as less than 100 feet wide. Here are just three of the relevant recommendations:

a.1. " A distance of at least 10 miles downstream from the proposed centerline of the pipeline should be used for the identification of sensitive areas and for identifying CPSs during the final design phase of the Project. " (p. xiv of Executive summary. CPS is "contributory pipeline segments" used by PHMSA associated with High Consequence Areas.) This distance was arrived at using "ecologically relevant criteria," according to the report.

Relevance to the proposed Sandpiper/Line 3 route and to the evaluation of system alternatives. There are very many small streams crossed on the Enbridge proposed route. Furthermore, the 10 mile distance is highly relevant to the width of the corridors used in the system alternative comparison being conducted now by DOC. It indicates that using a narrow corridor, such as two miles in width, would not fully capture the possible impact zone. Nor would it allow findings that a wide corridor with less concentration of small streams would be more favorable to moving a centerline than a corridor saturated with small streams. I note that Itasca State Park is easily within 10 miles of the proposed route.

V.D.2. a.2. Exponent recommendation regarding burial depth in stream crossings. "Keystone should rely upon stream-specific scour analyses for small stream crossings to identify where the pipeline should be buried deeper than 5 ft. or where horizontal directional drilling may be warranted." (p. xv.)

Relevance to the proposed route and to the evaluation of system alternatives. Depth of scour in general is an important issue, given the more intense precipitation events of the last few years. Deeper burial with more cover in trenched crossings may be a proper response to such events. Furthermore, Enbridge did not address this topic in its Environmental report, even though the Exxon pipeline rupture in the Yellowstone River was caused by scour and debris breaking the exposed pipeline during an exceptionally high runoff event in 2010. The may be a factor in route comparisons because the proposed Enbridge route has many small streams associated with groundwater discharge, which is likely to increase drilling mud releases. It is clearly a permitting issue for the DNR as well.

Not only that, but the EIS should address whether the existing pipelines in the corridor have adequate cover, since they are part of the industrial facility proposed to be enlarged by two more large pipelines.

V.D. 2. b. Exponent recommendation regarding risk associated with downstream transport via waterways in general . The study notes that the Keystone Final EIS indicates more analysis would be required after selection of the centerline. Included in that category was that further analysis of downstream transport distances in waterways was needed. It cites the Enbridge Michigan rupture into the Kalamazoo River in support of the recommendation.

Relevance to the proposed route and to the evaluation of system alternatives. As noted elsewhere, the large Enbridge spill cleanup involves a 35 mile stretch of the Kalamazoo River. There are locations in Minnesota crossed by the proposed route where the gradient is steeper than it is on rivers within the other system alternative locations. This can mean very rapid downstream travel of an oil spill. The fact is, the Enbridge Michigan event is now clearly entering into the calculation of risks. Furthermore, it appears to have *changed* actual calculation of risk. Essentially, this means that sometimes the real world enters into the modelling profession. Coupled with high consequences and unpredictability of human error, it means great care needs to be taken in choosing the methods of comparing alternatives, and deciding on whether to issue a Certificate of Need for the proposed route for these pipelines.

V.D.2. c. Exponent discussions of groundwater impacts from "small" leaks. The topic of groundwater contamination is very pertinent to the proposed and alternate routes for these proposed projects. The Exponent Report contains a large amount of information on assessing this potential impact, including methods and analysis of the product carried by the pipeline. However, there is one interesting issue that stands out, the topic of "pin-hole leaks." During the review of Alberta Clipper, Southern Lights, and MinnCan, agency staff was unable to obtain predictive knowledge of amounts and manner of detection. The Exponent Report sheds important light on this information, as follows:

"*Because small leaks may go undetected for longer periods of time, there is a potential for transport of oil spilled from the pipeline (i.e., diluted bitumen or synthetic crude oil) and the development of a dissolved constituent (i.e., benzene) plume that could ultimately result in impacts to groundwater resources down gradient from the pipeline. The potential extent of down gradient impacts is not quantitatively evaluated in the FEIS and discussed here. . . . ."For buried pipe in sloping terrain, lateral migration of oil could be greater, but also may result in surface expression sooner, when a barrier to oil flow (e.g., trench blocker) is encountered*." (p. 32. Note: FEIS means the Final EIS on Keystone.)

"*According to the report prepared by Battelle (2011), a leak rate of 28 bbl./day is expected from a "pin-hole" leak defined as a leak through a 1/32-in. diameter hole. The duration or time to surfacing would be dependent on the area over which oil infiltration occurs. If the oil spreads to a larger footprint, surfacing and potential detection will take longer than if the oil spreads to a smaller footprint. The size of the spill footprint will depend on several site-specific factors including but not limited to the permeability of trench backfill, and the permeability of soil surrounding the pipe trench. However, it is likely that a spill of 28 bbl/day would result in oil surfacing and being detected on the time scale of a few months."* (Exponent Report, p. 35. Emphasis added. Note: bbl/day means "barrels per day" and a barrel is 42 gallons.)

Relevance to the proposed route and to the evaluation of system alternatives. This information is obviously highly relevant to the necessary analysis of potential impacts, since it provides concrete information on the amounts of oil that can potentially leak that can only be detected when it reaches the surface. It also provides highly relevant information regarding route comparisons. Lateral movement of groundwater—a very important factor once crude oil enters the groundwater—is dependent on landscape types. And inferences can be made about lateral movement rates depending on the terrain of the different system alternatives.

V.E. Environmental Protection Agency reviewal letter on Keystone draft Supplemental EIS on Keystone.

This letter is dated April 22, 2013, and was sent to the US Department of State, the preparer of the federal EIS needed before a Presidential Permit can be given. It originates in the fact that the federal law regarding environmental review designates the EPA as, in effect, a quality control agency for federal EISs. This letter provides recommendations based on a high level of expertise and authority regarding compliance with Clean Water Act regulations with respect to oil spills and avoidance of oil spills by consideration of alternatives.

This letter contains multiple recommendations and findings relevant to the proposed Sandpiper/Line 3 project. Rather than quoting the lengthy relevant findings, here is a summary of main points:

1. The 2010 Enbridge Michigan spill of oil sands crude may require different response plans, and different impacts than spills of conventional oil.

2. It notes that on Keystone, the detection limits for early detection of a leak was 1.5- 2 % of pipeline flow, indicating substantial amounts of leakage before detection on the surface. (This figure was also mentioned in the Exponent Report.) (Note: Given the very large flows in the Enbridge pipelines, such leaks could be large before being detected, and could travel significant distances from the pipeline in hilly terrain and in areas with rapid lateral groundwater flow.)

3. The special constituents of tar sand oil could cause long-term toxicological impacts to organisms in the aquatic environment, and impact not as prominent in conventional oils. The letter supports findings that impact assessment studies need to examine the characteristics of the product with respect to environmental impacts of spills, because impacts differ among products.

4. The letter notes that significant improvements in reducing impacts have resulted from moving routes to avoid special groundwater areas. But then, very significantly, the letter goes on *to object to the eliminating of longer routes primarily because they were longer than the applicant's proposed route*. The letter indicates that the longer routes would reduce potential impacts to groundwater. It recommends that further justification be provided for eliminated the routes, or studying them further.

V.F. Conclusions about "significance of environmental effects" over the life of the project.
There are a number of conclusions regarding analyzing operation impact for the probable life of the project. I draw these conclusions based on my experience with formulating plans for major EISs based on studying technical documents, and on commenting on major EISs prepared by others. The potential impact I have focused on in this section is the need for careful assessment of pipeline leaks, accidents, and ruptures. Here are some important conclusions that can be drawn based on proper use of environmental review policies:

V.F.1. The environmental consequences of oil loss to the environment, including large amounts of oil releases due to pipeline ruptures, needs to be thoroughly examined in spite of evidence that many miles of pipeline don't leak or rupture. In other words, this information is needed in spite of such events being rare and of low likelihood—even *very low likelihood*. Furthermore, such an analysis is standard procedure in methods of studying this topic, and, if not done would not be considered a proper risk analysis. Should a pipeline rupture of the magnitude of the Michigan event happen along certain areas of the proposed Enbridge route, environmental damage could be enormous.

V.F.2. The environmental consequences of rare events that could occur during the project life (50 years for the sake of this discussion) needs to be a major factor in comparing routes, since the consequences, and response time, will differ on the routes. An EIS on both Enbridge projects

must examine the consequences of pipeline failure in any proposed locations and on alternative routes, rather than just assume it won't happen or to not think about it.

V.F.3. Enbridge has firmly stated they *must* use the Clearbrook terminal, and *must* have the project endpoint as being Superior, Wisconsin. Enbridge also insists that longer alternative routes are not feasible because of increased costs. But the potential consequences of large events along the proposed route are so significant and damaging so as to strongly indicate—based on even a preliminary look at relevant information provided in other risks assessments, related studies, and actual events—that issuance of a Certificate of Need for the proposed route may be questionable. At a minimum, such issuance would have to meet a very high bar of detailed analysis subject to public review.

According to Enbridge's own filings, costs of a pipeline rupture in an actual sensitive area in Michigan have reached $1.21 billion. To me, this questions their argument that a longer route is more costly over the project life. Furthermore, Enbridge has supplied no information on consequences of pipeline ruptures on its routes, even though the information exists and has been given to the federal government. Given these various factors, an EIS must take a hard look at the Enbridge system and examine other alternate endpoints. A possible useful exercise would be to make a finding by the PUC that Enbridge needed to supply—as information to be used in the EIS—alternative plans for pipelines that do not need a Superior endpoint.

V.F.4. Given the potential consequences of natural resource impacts along the proposed route, added length of a safer route should not be a determinate for eliminating it from presentation as a viable alternative. This is a similar conclusion to that reached by the EPA on Keystone.

V.F.5. It is evident that the role of human error in pipeline accidents (a misnomer perhaps because "accident" implies something that couldn't be avoided) has been a major factor. It also is more difficult to control for and more difficult to predict. This needs to be taken into consideration in any kind of risk assessment.

V.F.6. Enbridge demonstrably does not have a good track record of responding to serious events. In spite of the huge spill in Michigan, another spill occurred two years later that was found to have the same sort of mismanagement and lack of appropriate response. It is likely that, on the day before the very large Michigan accident, Enbridge management officials, as well as PHMSA officials, would have provided strong assurances that this pipeline was safe to operate if they had been asked. This must be a factor in decisions regarding these proposed projects, albeit a subjective factor. A thorough inquiry into all records on the topic of management response to evidence of pipeline anomalies needs to be investigated in the EIS.

V.F.7. There are serious questions as to the adequacy of federal oversight of pipelines, based on material I have provided in this testimony. The United States Constitution provides its individual states certain rights not to be abrogated by the federal government. Given the serious charges laid on the federal government by the NTSB report, and the fact that there has been no strengthening of federal laws since this report, Minnesota citizens, in my opinion, expect the PUC to assert this State's right to delve deeply into these subjects via a thorough EIS.

V.F.8. Risk assessment methods should be applied to the risk of pipeline product entering streams, and traveling for some distance, given the topography along the proposed route. Further, this risk assessment needs to address the condition of the existing pipelines and the likelihood that a rupture accompanied by a fire would damage adjacent pipelines (See Appendix 1.)

V.F.9. The MEQB should be designated as the RGU for the EIS on the Certificate of Need, given the complexity of the needed review, its ability to coordinate among agencies, and its familiarity with effective public participation methods.

VI. OVERVIEW OF INSTALLATION OF LARGE DIAMETER PIPELINES AND RESULTING ENVIRONMENTAL IMPACTS.

VI.A. Introduction. This section attempts to answer the questions: What are the special features of installation of large diameter pipelines that cause impacts—especially long term impacts? Each of the 10 features identified in this section also includes commentary on the main impacts associated with the construction feature, and how it is related to comparison of routes. The intent here is to help in scoping for the EIS on these projects.

Section VII follows this discussion by critiquing Enbridge's environmental documentation, and noting whether there are specific permits to address impacts.
Enbridge has submitted a lengthy environmental information report, including some descriptions of environmental impacts and plans to minimize impacts. In order to understand the adequacy of this information, it is important to understand how large pipelines are installed. Pipeline construction is unique when compared to most other large construction projects. Most other projects involve a permanent change to the landscape. When done correctly, pipeline construction involves lots of earth moving, but is followed by effective replacement of the original landscape, soil reclamation, and revegetation, with the exception that grasses replace woody vegetation over the pipeline.

The following discussion, and that in Section VII, focuses on those aspects of construction that cause the most important impacts, are generic to the whole project in Minnesota, and that therefore cover the most acreage of affected area. My review of the adequacy Enbridge's documentation is based on these factors.

My review is also based on a report I prepared some years ago while working for the State of Montana. (Appendix 3.)This report describes ROW requirements in flat terrain vs hilly terrain. It has been requested by a number of pipeline companies I have worked with as a regulator. It also has been viewed as a primer on pipeline construction for persons unacquainted with such projects. None of these companies challenged any of its findings. I have previously submitted this document to the Commerce Department (See Appendix 1 and 2, and especially Appendix 2 for an explanation of this report.)

The portions of the Montana report concerning ROW construction requirements are essentially applicable today, except perhaps as regards to possible additional widening because of worker safety protection. (Also, pipeline companies have somewhat differing views on how to

construct properly.) The report covered the right of way requirements for constructing the 180 mile long Northern Border 42-inch natural gas pipeline in Montana on flat terrain as compared to hilly terrain. The company had underestimated the ROW requirements in hilly terrain, causing construction delays and problems with landowners. The company originally asked for a 100-foot construction ROW but this proved wildly inadequate in hilly terrain, some of which is similar to that along the proposed Sandpiper route. I documented why the need to construct a level work pad in hilly terrain was the primary factor in right of way expansion beyond that requested. In some cases, the ROW became several hundred feet wide in hilly terrain. It is hereby incorporated into the record as part of my testimony.

VI.B. <u>Multiple choreographed operations moving along at rapid pace, including multiple inspection activities</u>. An rule of thumb that is sometimes used is that in open flat land, a mile of large diameter pipeline can be installed per day. Generally, this is more difficult to achieve in hilly terrain. There are multiple operations needed to accomplish installation, usually involving separate specialized crews. This starts with land clearing, then proceeds with construction of a level "work pad" involving excavation into hillsides, installation of temporary bridges over waterways, installation of temporary erosion control measures, pipe stringing, trench ditching, pipe bending, welding, pipe burial, re-contouring of hillsides, installation of permanent erosion control measures, topsoil replacement, and re-seeding.

Separate crews are often used for each of these operations, depending on site conditions and contractor preference. Worker safety is an important element because of the intensity of activities, and ROW construction width is influenced by these needs. River crossings are usually done with specialized crews. Pipe segments are then tied into the completed overland sections separately, coated with cathodic protection, x-rayed, inspected, and buried.

Multiple inspectors are on site at all times during construction to ensure proper installation. These include environmental inspectors working for the company, and can include independent inspectors reporting to state agencies (This occurred on the Alberta Clipper and Southern Lights projects.). Many other inspectors deal with pipe installation and engineering issues. Also, constant daily communication among construction supervisors and environmental inspectors is an important element in this fast moving construction operation. This also allows rapid communication with government regulatory personnel *if properly set up as a requirement of permits.* One of the most important reasons for this management system is that rain events and unexpected conditions can occur that need quick attention so as to not shut down the whole operation. This also reduces potential impacts during such events because it facilitates communication among environmental inspectors.

V.B.1. ***Main environmental impact issues*****:** a) Interruption of any of these operations can cascade to other operations, some of which can result in increased adverse impacts, such as increased erosion into waterways. b) Environmental inspection by independent inspectors during construction is extremely important because of the rapidity of change in operations, speed of movement, and changing environmental conditions such as high rainfall events. Independent environmental inspectors reporting to state agencies are necessary. On every project where I was a state inspector, I have been told by company environmental inspectors that

my role was crucial to them. If I wasn't present, they said, their ability to obtain compliance and rectification of on-site problems was lessened.

V.B.2. ***Relevance to route comparisons, including system alternatives***. There are essentially two ways whereby the complexity of pipeline installation choreography needs to be factored into comparing routes and corridors:

a) On hilly terrain, managing the various parts of pipeline construction is more complex and more risky. Therefore, efficient management can reduce adverse environmental impacts;

b) When following an existing pipeline corridor, as part of the Enbridge proposal does, equipment operation and management is more constrained, especially in certain locations because there is existing pipe on one side of the trench and therefore heavy equipment can't operate on top of these lines; and

c) At other areas, there may be "choke points" on the other, working side of the pipeline. For example, for the sake of making the point, assume there is a cemetery or rare plant community close to the existing pipeline. The choice then becomes whether to squeeze the new pipeline into this narrow area, or construct two "cross-overs" to drill under the existing pipelines, and then back again after the "choke point" is passed. In other words, engineering and construction become lots more complicated.
Therefore, the comparison of routes needs to add a negative factor for following an existing corridor with respect to complexity and difficulty of construction.

VI.C. Construction on hilly terrain vs flat terrain. These two landscape conditions have profoundly different effects for the installation of large diameter pipelines. Construction companies can routinely handle both kinds of landscapes; however, there are large potential impact differences as well as environmental risk issues. Appendix 3 provides further documentation.

VI.C. 1. *Relevance to impacts:*

a) On flat terrain, the construction ROW can be substantially narrower than hilly terrain because there is less area needed for spoil storage except for the trench spoil and topsoil that is separated. In my experience with all the large diameter pipelines I have worked on, pipeline companies readily agreed to an 85-foot right of way as being adequate in flat terrain.

b) On flat terrain there is much less potential for water erosion during and afgter large rainfall events.

c) On flat terrain coordinating the various construction crews is more straightforward and predictable, and environmental inspection needs are substantially less.

d) There would be a large difference between flat terrain and hilly terrain if there is a pipeline accident, since pipeline product would spread much faster on hilly terrain as compared to flat terrain.

These large differences with respect to environmental impacts are explained in more detail in the following sections.

VI.C.2. *Relevance to route comparisons*: Some of the following sections point out how hilly terrain increases impacts. Fuidance as to how to compare routes on the basis of flat terrain vs hilly terrain is provided. For example, an 85-foot construction ROW could be used to calculate land requirements on flat terrain, as compared to 175-200 foot wide construction ROW in areas of side-hill cutting accompanied by topsoil separation in all excavated areas. (See Appendix 2 and 3.)

VI.D. Installing large diameter pipelines adjacent to existing pipelines. It is often considered by the public and others that following existing pipeline corridors is an advantage. It is clear that following existing corridors in some locations is an advantage. However, there are important factors that can greatly increase installation complexity and environmental impacts in other locations. The problems with some existing corridors—including some non-pipeline corridors—include:

VI.D.1 Corridors were established prior to almost all federal and state environmental laws, and therefore are often located in highly environmentally sensitive areas. Adding more lines accelerates the cumulative impacts to these areas.

VI.D.2 Enbridge's stated purpose is to install its pipeline about 50 feet offset from the existing lines, and Line 3 offset (apparently) by another 50 feet. However, there are many locations where this is not possible, or at least very undesirable. Examples include home sites close to the existing corridor (resulting in uprooting and buy-outs of people), and highly important natural resources right next to the existing pipeline. Such features would have been avoided when locating a new pipeline. This results in centerline changes to avoid such issues, or complicated cross-overs. All of this results in a sprawling corridor over a wide area. Among other adverse results, this results in habitat fragmentation in wildlife areas.

Essentially, the basic problem is that following existing pipelines greatly increases the likelihood of that otherwise avoidable impacts can't be avoided because of the "rule" that an existing line needs to be closely followed.

VI.D.3 There are many locations on existing corridors that cross rivers and floodplains at an oblique angle, thus increasing the potential for damage. A new line would cross such features at a perpendicular angle.

VI.D.4 Adding pipelines closely adjacent to an existing pipeline concentrates such facilities. While some view this as an advantage, there are also clear disadvantages. For example if there was a leak or rupture, clean-up becomes more complicated. Also, concentrations increase the attractiveness to a party deliberately seeking to cause damage. If accompanied by an explosion, the other adjacent pipelines could be threatened.

VI.D.5. There are also clear adverse impacts to wildlife in that a corridor becomes very wide as pipelines are added to the corridor. This is an adverse impact to species that follow cover along river banks—since a wide gap is created that exposes wildlife to predation. (I have personally

observed avian predators sitting on a tree next to such a wide pipeline area, apparently waiting for a mink or other animal to cross the exposed stream bank.)

VI.D.6. *Main impact issues*: There are serious and varied adverse impacts associated with following an existing pipeline, since the guiding principle—following an existing line established many years ago—greatly reduces the ability to avoid sensitive natural resources. In addition, there is at least an incremental increased risk of catastrophic oil releases.

VI.D.7. *Relevance to route comparisons*: When comparing routes, including system alternatives, the disadvantages of following pre-environmental law and regulation corridors must be considered a strong negative. The first step in so doing is carefully assessing the overall problems with the existing corridor.

VI.E. The construction right-of-way functions as a temporary road. Installing large pipelines require the use of heavy equipment that cannot drive on roads without damaging them. Large machines are needed to excavate large areas in hilly terrain and to move heavy pipe. In addition, enough work space is needed to allow equipment passage around other equipment—since multiple crews are present—and to ensure worker safety. (See Appendix 2 and 3.) Therefore, the ROW essentially becomes a temporary road until installation is completed. The distance of ROW cleared ahead of the other operations is a subjective factor that varies with projects, and whether or not permit requirements address this issue.

VI.E. 1. *Main impact issues*: All of the following are approptiate topics for assessment of impacts of the projects as proposed, and mitigation measures identified.

a) Long-term soil, subsoil, or parent material compaction can result, especially on certain soils and if there is lots of traffic under wet conditions.

b) Damage to topsoil from repeated passage of heavy equipment if topsoil is not stripped from the construction lane,

c) Length of time ROW functions as a road, and the length of the opened ROW is important. For example, it may be financially beneficial for the contractor to clear and grade 5 miles of ROW, but such a practice is not actually necessary for pipeline construction, and

d) wind and water erosion risk substantially increases when clearing crews get far ahead of the installation crews.

VI.E.2 *Relevance to route comparisons:* All routes will of course have construction proceeding in the manner I have described, such as using the ROW as a temporary road. However, there will be differences in construction costs and construction complexity as a function of how much flat land and special features (such as river crossings) there are on different routes.

VI.F. Pipe trenching. Excavation of a trench for pipe burial is at variable depths. On farmland, Minnesota regulations say that landowners can ask for and receive 54 inches of cover over the pipe. However, Enbridge says it will seek to have landowners waive this requirement.

VI.F.1. *Main impact issues*: Topsoil can be lost because of mixing with parent material spoil, unless it is separated prior to trenching. If not separated, re-vegetation suffers, areas are subject to invasive species establishment, and, on hillsides, erosion potential is higher. If pipe is buried at a shallower depth, heat from the oil will result in earlier growth in the spring, and possible drying out of soil above the pipe during the growing season. This effect is heightened downstream of pump stations because of higher oil temperatures. These will both be a long term impacts.

VI.F.2. *Relevance to route comparisons:* Likely no difference in route comparisons, other than that associated with differences in amounts of farmland, and possibly soil susceptibility to compaction.

VI.G. Topsoil separation in general. Enbridge has portrayed several possibilities regarding topsoil separation; therefore I have separated out this construction technique. They indicate in diagrams that several scenarios for topsoil separation on the construction ROW. However, they don't estimate acreages that will receive these different treatments.

VI.G.1. *Main impact issues*: It is entirely established that degrading topsoil by being mixed with parent material from three or more feet below the surface is a long-term adverse impact. As noted elsewhere, and in Appendix 2 and 3, the potential area where this can occur on large diameter pipelines constructed in hilly terrain can be large. Enbridge has not calculated this area under the conditions of their proposal. Careful topsoil separation in any excavated or high traffic areas has environmental benefits, such as rapidity of reclamation, less invasion of exotic species, and return of crop and forest productivity, etc. Without having estimates of the different Enbridge practices, this impact can't be accurately estimated.

VI.G. 2. *Relevance to route comparisons*. Enbridge's specific plans regarding topsoil separation should be used to compare routes, prior to any assumption as to whether permitting agencies will require additional stripping. At this point, Enbridge plans only to separate topsoil on farmland and at the request of landowners. Since not separating topsoil causes long-term impacts, there will be higher long-term impacts on routes with less farmland.

VI.H. Construction of a level work pad, especially on hillsides. During clearing operations when the sites are readied for other crews to do their work, the equipment operation area next to the trench—the "working side" where all the equipment operations and traffic occurs—is often called the "work pad." In my experience, a rough standard width is approximately 50 feet on most of the projects I have worked on. (Note: it is possible this has been enlarged due new to safety procedures.)Heavy pipeline equipment cannot safely operate on side-hills. Therefore, in preparing the work pad, a level area is excavated when crossing the side of a hill. The fact that it needs to be level is very important with respect to accurately determining impacts. Creating a 50-foot wide level work pad on steeper hillsides can mean excavation into soil parent material can be 8 or 9 feet deep. (See Appendix 2 and 3.)

The proposed route crosses extensive areas of hilly terrain. Therefore there will be substantial acreage of excavation into side-hills, but the Enbridge documents don't recognize this as an impact and don't mention it. The area needed for spoil storage can be high, and the temporary

ROW needed to construct can be 200-300 feet wide. (Note: This was the case on the North Side of LaSalle Creek where Enbridge is proposing to install its pipelines. It was even wider than 300 feet in one location.) When topsoil is separated, a wider area is usually needed. These impacts will be a long-term, and can be easily observed on Enbridge's mainline corridor.

VI.H. 1. *Main impact issues*: Topsoil will be lost or degraded because of mixing with parent material spoil, unless it is separated prior to trenching. If not separated, re-vegetation suffers, areas are subject to invasive species establishment, and, on hillsides, erosion potential is higher. If not separated, such impacts will be long- term on hilly land. The construction ROW can become very wide because of spoil storage and topsoil separation.

VI.H.2. *Relevance to route comparisons*: Modern GIS systems should be able to calculate slopes on the various alternate routes. Routes should be compared based on Enbridge's plans for where they will definitely separate topsoil and where they will leave it up to the landowner should be used as comparison factors. Based on my experience with past Enbridge projects, there was little or none topsoil separation in forested areas and other non-farmland areas.

VI.I. Deep pipeline burial on certain locations on hilly land. On hilly land, the pipeline is not buried to follow the exact ground contour. Rather, the engineering design attempts to reduce the extent of bends by "smoothing out" the bends. This can be accomplished by deeper burial, for example, at the crests of sharp but small hills. Other locations are at river terraces, or river banks for trenched river crossings. (See Appendices 1-3 for more detail.)

Main impact issues. Same issues as discussed for construction of a work pad on hilly terrain.

Relevance to route comparisons: Similar to that above on construction of a level work pad.

VI.J. Damage to rivers and waterways during construction. There are a number of ways of crossing floodplains and rivers. Most of these are covered by permits and are conducive to mandatory mitigation by permitting authorities. Therefore, I will not go into this in detail except for pointing out areas where there is unclear permitting authority. Here are important issues not clearly covered by permitting authority, or are outside of DNR jurisdiction (the top of the riverbank in most locations):

VI.J. 1. Adjusting pipeline route/centerline to cross rivers and floodplains properly. The least impact crossing of floodplains, waterways, and river valleys is to cross the large feature perpendicularly, and the waterway itself between meanders at a perpendicular angle. Crossing at less than a 90% angle unnecessarily increases impacts because the crossing length increases. Therefore, best practices in large pipeline installation is to cross at the perpendicular angle when siting a pipeline, unless there are clearly other features that would more severely be impacted.

It is unclear as to who has the jurisdiction and/or willingness to require this of Enbridge. DNR's jurisdiction for its License to Cross stops at the high-water mark of the waterway, which is usually the top of the riverbank.

VI.J.2. Crossing waterways and wetlands by deep directional drilling. This method can potentially greatly reduce impacts if it works as planned, and is used more and more as equipment improves. The technique involves deep drilling under waterways and sometimes adjacent wetlands. Such a technique uses specialized (and large for a 36 inch line) equipment, and is usually called an "HDD." Depth can be 25-30 or more feet under the river bed, and length of drills is variable, but can be 3,000 or more feet long in order to avoid sharp bends. The entire pipe is welded for the length of the drill, and pushed/pulled through a bore that is created prior to the bore.

Unfortunately, this technique can sometimes cause big environmental and construction problems when things go wrong. This happened on a number of locations on Enbridge's proposed Sandpiper/Line 3 route during the construction of the 24-inch MinnCan project. Drilling mud escaped during the HDDs at a number of the rivers and wetlands, including at LaSalle Creek, Mississippi river and Straight River as well as others. Mud is primarily bentonite, which is non-toxic. However, additives are used. In the case of MinnCan, the construction company and consultants tried to claim that the additives were a trade secret. DNR and PCA had a difficult time obtaining the information on the additives, if at all. According to available information, some additives are toxic to fish.

VI.J.3. Main impact issues: There are four main impact issues:

a) The portion of the Enbridge proposal that follows the existing corridors means that river floodplains and the rivers themselves will be crossed at less than desirable locations if the offset from the existing lines is as proposed by Enbridge. This is likely especially true at floodplain crossings. Furthermore, adjustment of the centerline to try to cross the river itself at a perpendicular could well result in impacts to other riverine features.

b) There is strong evidence that areas with upwelling groundwater increase the likelihood of drilling mud reaching the surface or reaching the river via the riverbed or flowing from adjacent areas. Crossing the floodplain at an oblique angle means the HDD length is longer, and likely increases the likelihood of drilling mud releases.

c) The portion of the Enbridge route between Clearbrook and Park Rapids had many locations where drilling mud reached the surface in wetlands, riverbeds, and locations immediately adjacent to rivers. In my experience with pipeline projects, this incidence was by far the highest of any projects I have worked on as a regulator.

d) Drilling mud entering wetlands would be considered fill. On MinnCan, in some locations many cubic yards of drilling mud entered wetlands. Drilling mud entering streams coats the bottom, since bentonite is heavier than water.

VI.J.5. *Relevance to route comparisons*: 1) The portion of the Sandpiper/Line #3 projects that follow the existing corridor can be examined to determine where floodplains and waterways are crossed at less than desirable (best practice) locations. This can be also done on Enbridge's proposed Greenfield route. This date can then be compared to other system alternative routes with the assumption that most if not all will be crossed in a proper manner. 2) Routes with hilly

terrain and isolated wetlands will likely have more drilling mud releases because of more groundwater areas reaching the surface.

VI.K. Wetland crossings. Pipeline companies sometimes will say that impacts to wetlands are temporary. Enbridge did this on its Alberta Clipper and Southern Lights projects. Examination of existing pipeline corridors indicates that impacts can be long-term. The most obvious change can be seen in older pipelines where there is a strip of woody vegetation marking the place where the pipe is buried in the wetland. The cause of this is likely two-fold: Wetland soil compaction, and the fact that the pipeline itself is essentially fill, and thus the wetland surface is raised and becomes drier when the spoil is returned to the trench.

VI.K.1. *Main impact issues*: Soil compaction in wetlands and whether an amount of wetland soils is removed that approximately equals the volume of the pipe through the wetland. If not removed, changes in wetlands will occur. For example, a 200 foot crossing of a wetland by the 36 inch Sandpiper pipe results in 36 cubic yards of fill into the wetland, or about 4 loads of a 9 yard dump truck. This will result in vegetation changes in many locations and is, or should be, considered fill under wetland regulations.

VI.K.2. *Comparison of routes*: Distance of wetland crossed can be used to compare routes. Since some of the routes don't have a specific centerline, a surrogate needs to be developed that determines the ease at which a wetland can be avoided in a route/corridor.

VII. WHAT ARE THE MAIN ENVIRONMENTAL IMPACTS OF PIPELINES, SUMMARIZED, AND HAVE THEY BEEN ADEQUATELY IDENTIFIED AND ANALYZED FOR THE TWO ENBRIDGE PROJECTS, AND WHAT, IF ANY, PERMIT AUTHORITY IN MINNESOTA OR FEDERAL LAW EXISTS TO REQUIRE MITIGATION OF SUCH IMPACTS?

The intent of this section is to focus on the potential impacts caused by the construction operations discussed in Section VI. The focus is also on the impacts that affect the largest area, that extend into the future, and to see whether Enbridge has addressed them in its report. As such, there is some redundancy with Section VI.

Authors note: Operational impacts over the 50 year project life—pipeline ruptures and leaks—are discussed in Section V.

VII.A. Introduction. Construction and Installation of large diameter pipelines is not like other construction projects. *If done correctly*, the earth is opened up, the pipe is buried, and the landscape is returned to its previous condition. Soil productivity is not reduced on all lands, topsoil is not lost or damaged, soil compaction is addressed properly, and re-vegetation occurs. Water and wind erosion are not worse that before installation. The only permanent change is that woody vegetation over and adjacent to the pipeline is not allowed to return.

This description of what occurs when *correct* best management practices are followed is a fundamentally important guide to judge Enbridge's proposal against. I have reviewed Enbridge's Minnesota Environmental Report (January 31 2014 revision) and pertinent parts of other

Enbridge documents with this guide in mind. The following discussion focuses primarily on topics where Enbridge's proposal is seriously deficient. I also point out what I believe is the permitting authority for addressing these deficiencies.

VII. B. <u>General comments on Enbridge's environmental report and documentation</u>. A central question as to an EIS determination is: Have potential significant impacts of construction and operation of Sandpiper/Line 3 on the proposed route been identified, and have mitigation measures for such impacts been identified? The answer is clearly no. Enbridge's documentation is deficient for at least the following reasons:

VII.B.1 Enbridge's report is not a sufficient assessment of impacts. It includes limited generic comments about adverse impacts, and some statements of amounts of resources impacted. These statements appear to be based on generic assumptions of ROW width rather than actual site conditions. It also includes many statements saying mitigation practices "could" occur, with no commitment or analysis of wehre practices are needed.

VII.B.2. It follows that if there is insufficient impact identification and assessment, there is insufficient mitigation—since the latter depends on the former.

VII.B.3. A major defect is that it doesn't have any analysis of the adverse impacts of following existing pipeline corridors—in spite of an awareness of the phenomenon of "corridor fatigue" and Minnesota's regulations regarding cumulative impacts. Clearly, in some places, following an existing corridor established long before environmental laws and regulations were passed, means rivers and floodplains are crossed at improper locations. It means avoidance of impacts is overruled by the necessity of staying close to existing pipelines, even when they crowd up against sensitive natural resources.

VII.B.4. The report is silent on the impacts of drilling mud releases, even though these were common on the route south of Clearbrook. Response plans for such releases are included, but they don't substitute for impact assessment. Furthermore, they may be insufficient to match the impacts that could occur.

VII.B.5. Enbridge does not adequately describe why it needs certain ROW widths, nor the width of the work pad.

VII.B.6. There is no discussion of the potential impacts from the (likely) at least 50 year operation of the pipelines. This analysis should include, according to federal regulations for pipeline operators of existing pipelines(of a certain size) to submit to the federal Office of Pipeline Safety ". . .response plans, ...statements of significant and substantial harm, . . . worst case discharges. . . .(and) general response plan requirements. . ." (DOT PHMSA regulations 194.101, 194.103, 194.105, and 194.107, respectively.)

In would appear that Enbridge has information on file about its existing lines, since these are PHMSA mandatory requirements. The information could be used to apply to the assessment of Sandpiper/Alberta Clipper. Enbridge hasn't revealed this highly relevant information.

VII.C. Enbridge's "Environmental Protection Plan (EPP)." Such plans are an important element in pipeline construction, and Enbridge has one in its documentation. (Appendix A of Vol. 1 of its Minnesota Environment Information Report for Sandpiper.) Such plans are typically used by pipeline companies as their main guidance for environmental mitigation, and are reviewed by permitting agencies.

Many of the items in the Enbridge's Erosion Control and Revegetation plans are sufficient as generic concepts, and it could be assumed they will be appropriately applied. But this is also a function of having state involvement in environmental inspection, and Enbridge does not propose this as they agreed to on the two recent pipelines. As noted elsewhere, however, since Enbridge has not supplied an adequate assessment of impact, one can't determine adequacy of how it plans to apply this plan.

However, the plan for topsoil separation is seriously deficient because the area where it will definitely occur is only on agricultural land. Enbridge notes that it is following the May 2013 Federal Energy Regulatory Commission's (FERC) Upland Erosion Control, Revegetation, and Maintenance Plan as guidance for Best Management Practices. However, the FERC plan is deficient in that it also does not adequately address topsoil loss, since it makes topsoil separation on non-farmland an optional practice. Also, the FERC plan doesn't address the issue of excavation in areas outside of the trench such as in hilly areas. Finally, the FERC has jurisdiction over gas pipelines, and there is federal preemption on such facilities. There is no such federal preemption on oil pipelines.

Clearly, loss of topsoil causes long term problems. This cannot be factually challenged. I believe that if the FERC—and Enbridge—BMP's are followed, the criteria I described in the first paragraph of this section will not be met.

VII.D. Summary of impacts caused by installation of large diameter pipelines and Enbridge's response.

All of the impacts listed in this section *involve significant habitats or large acreages* on the Enbridge projects. Therefore, they are major impact and mitigation topics that must be given proper attention in an EIS.

VII.D.1. Topsoil loss or damage from trenching for the pipeline ditch and on side hill cuts. Long-term adverse impacts occur when topsoil is lost by mixing with parent material. Such impacts occur in a*ny* area where there is excavation into the parent material without separating topsoil first. Impacts include loss of soil productivity, sparse and limited re-vegetation, invasion of non-native exotic species and weeds, increased soil erosion on slopes, and sedimentation into wetlands and water bodies. All these impacts are significant no matter if farmland, wildlife land, forest land, or any other land use—except in already degraded areas.

Enbridge's plans. Enbridge's environmental report insufficiently assesses this impact. Enbridge only proposes to separate topsoil on excavation areas on farmland. Enbridge also is silent regarding the many other areas where excavation into parent material will occur other than over the ditch for pipe installation. The plan does say that topsoil will be separated in other areas according to landowner preferences. If the landowner is not properly informed, he/she will not

be able to make an informed decision. A proper impact assessment would estimate the acreage where productivity is lost because of topsoil loss, and also where there is increased invasion of exotic species and increased erosion due to reduced vegetative cover.

Permit authority to rectify. With respect to public lands, the DNR, counties, and other land managers can require separation as part of their permits to cross the lands. PCA may be able to require topsoil separation in their stormwater permit. Alternatively, the PUC can require it as a condition of its Route Permit.

VII.D. 2. Soil compaction. Soil compaction occurs when there is repeated heavy equipment traffic on the travel lane. Such compaction can last beyond the life of the project (greater than 50 years) in certain soils that are susceptible to compaction, especially when wet. There has been growing awareness of the seriousness of this issue. For example, compaction layers can prevent roots and moisture from reaching normal depths, and thus decrease productivity. If one assumes that the heavy equipment travel zone during construction is 50 feet wide, the area of this zone on the proposed 299 mile long pipeline is 1,800 acres subject to soil compaction from the Sandpiper project itself.

Enbridge's plans. Enbridge's report does not include estimates of the extent of this problem, and does not adequately address mitigation because it is silent on non-agricultural area compaction. The discussion in the draft Agricultural Mitigation Plan is revealing, in that it demonstrates what can occur in areas other than cropland—since it describes the benefits of topsoil separation.

Permit authority to rectify. With respect to public lands, the DNR, counties, and other land managers can require compaction alleviation as part of their permits to cross the lands. Alternatively, the PUC can require it as a condition of its Route Permit.

VII.D.3. Wind and water erosion from exposed soil. The greater the area of cleared land ahead of installation crews, the greater the risk that large rainfall events will cause erosion, topsoil loss, and sedimentation into waterbodies. According to Enbridge's calculation, about 5,140 acres will be temporarily impacted by the Sandpiper project. (Note: Enbridge does not supply enough information to determine if this is a correct figure.) This is the area that will be potentially subject to wind and water erosion during construction.

Enbridge's report and plans. One aspect of pipeline construction that can be controlled to reduce potential erosion impacts is how much ROW clearing will occur ahead of pipe installation crews. The Enbridge report is silent on this topic. On some pipeline projects I have been involved in, when this topic was not addressed in permitting, contractors cleared unnecessary miles ahead of installation, resulting in risk of severe erosion and sedimentation.

Permit authority to rectify. PCA may be able to require this via its stormwater permit; otherwise, the PUC could add the topic to its Route Permit.

VII.D.4. Permanent loss of forest habitat and fragmentation of habitat. Loss of habitat causes population losses in forest species. Fragmentation further degrades habitat.

Enbridge's report and plans. Enbridge does have an acreage figure for permanent loss of forest habitat—619 acres. However, its description of ROW requirements is generic, and somewhat wider than what is normally stated, such as for the Alberta Clipper project. The report is also completely unclear regarding the locations of additional ROW needs in hilly areas; therefore, one can't determine the accuracy of this figure. It may be lower if Enbridge can get by with a narrower ROW in certain areas.

A related topic has to do with removal of forests in temporary work spaces. Enbridge estimates that 1,524 acres of forest will be cleared temporarily. There is no explanation to indicate where this figure came from, such as whether it includes spoil storage areas in hilly terrain. Furthermore, Enbridge proposes to let natural re-growth or stump sprouting to allow return of forests. If topsoil has been lost in such areas, return of forests could well be very slow, since seedlings will have a hard time competing with invasive species for moisture.

Permit authority to rectify. The PUC would be the main authority able to require minimization of loss of forest habitat in general, and reforestation of temporary work areas. The DNR could require it on their lands.

VII.D.5. Permanent loss of woody riparian vegetation. Woody riparian vegetation is a very important ecological feature. Riparian areas are some of the richest and most productive habitats in ecosystems. Woody vegetation protects stream banks from erosion during high water events. These areas also provide cover for various animals following shorelines and river banks. Construction of a large pipeline means clearing of woody vegetation from a wide ROW, and when an existing corridor is used, the distance becomes significant to wildlife species. A wide gap results. Clearing extra work space needed to install the pipeline in the stream results in more clearing.

Enbridge's report and plans. Enbridge's reports do not discuss this important habitat. It also does not discuss the agreement that was reached to retain some of this habitat when the Alberta Clipper and Southern Lights projects were built. This agreement was instigated by the DNR.

Permit authority to rectify. Since the DNR's authority under its "License to Cross" Protected Waters ends at the top of the bank (or shoreline) in most cases. Therefore, DNR ability to require retention of at least some woody vegetation is difficult or not possible if Enbridge is adamant about its plans. The PCA might have some authority in its stormwater permit, but this might also be difficult. Therefore, the PUC route permit would be the main vehicle for requiring this in a permit.

VII.D.6. Impacts of drilling mud releases to the surface or into water bodies. As noted in Section V.J., there were frequent drilling mud releases into water bodies and wetlands during the construction of the MinnCan pipeline. Rivers included the Clearwater River floodplain, and the Mississippi and Straight Rivers. There was also some suspicion that these releases ("frac-outs" is a term sometimes used in the pipeline industry) were associated with groundwater upwelling. Therefore, this is a significant and important issue associated with attempts to accomplish HDDs. Enbridge proposed route is this same corridor.

Enbridge's report and plans. Enbridge's EPP does not analyze impacts of these releases. However, it does have a response plan to address such issues. Absent an assessment of potential impacts, it is hard to visualize having an adequate plan, since a plan must be based on an accurate knowledge of potential impacts. This needs to include firm knowledge of additives to the main constituent of drilling mud, which is bentonite.

Permit authority to rectify. A proper permit regarding drilling mud releases needs to require that all additives need to be known and approved beforehand by the DNR and PCA. It is unclear whether the DNR or PCA has this authority. Therefore, the PUC needs to require this in its Route Permit.

VII.D.7. Independent environmental inspector reporting to state agencies. During the construction of both MinnCan and the two recent Enbridge projects, an independent inspector reported to the DNR and PCA. This proved to be an indispensable position, given the problems with drilling mud releases and other factors. In those cases, this was funded by MinnCan and Enbridge.

Enbridge's report and plans. Enbridge is silent on funding an independent environmental inspector on the Sandpiper project, and says it will retain its own agricultural and environmental inspectors.

Permit authority to rectify. The PUC would be the authority to require these inspectors be retained and funded by Enbridge.

VII.D.8. Ideal location for large diameter pipelines. Aside from the issue of preference by some landowners, and social issues, the best *physical* location for a large pipeline is on land already cleared of natural vegetation, and that is also flat. This is often farmland. If true BMPs are followed, such as topsoil separated from the entire working area, and over the trench, and if the cover is 54 inches, and if deep ripping is thoroughly used to reduce soil compaction, there will be little or no productivity lost on farmland. In addition, roads are always present in farmland providing easy access should there be any kind of leak in the future.

VIII. Overview of problems with Minnesota policy regarding review of new large diameter pipelines.

VIII.A. Introduction. In my opinion, it is highly important to be aware of deficiencies with Minnesota's pipeline laws, regulations, and permitting regarding large-diameter pipelines. I hasten to add that I do know the Sandpiper project needs to proceed under existing law and regulations. However, acknowledging deficiencies at least allows some guidance as to proceeding under existing agency rules and policies.

Note that in various parts of this testimony, I have cited or developed information showing that the Enbridge Sandpiper project affects thousands of acres, and can potentially cause permanent changes of a magnitude far larger than other projects where MEQB rules require a mandatory EIS. *This means that the separate CN and Route Permit decisions by Commerce and the PUC are, in effect, major Minnesota environmental review processes*. Throughout my testimony, I

have described accepted practices for determining when an EIS is needed, for preparing EIS content including acceptable analysis of impacts when there is a high potential for adverse impacts. I have also noted applicable MEQB rule definitions and guidance for preparing and using ER documents. Therefore, I am judging these deficiencies in Minnesota policy based on answers to four questions:

1) It is not in contention that Minnesota's Environmental Policy Act applies to large pipelines; however, how does the approach to impact analyses of the Department of Commerce and PUC compare to other types of facilities of comparable size and impact magnitude reviewed under MEQB rules?

2) Are the rules and policies regarding how large pipelines are reviewed and decisions made on them as clearly defined as other facilities affecting comparable amounts of natural resources and landscapes?

3) Are the potential construction and operation impacts of large pipelines adequately covered by clear permit authority, in specific rule and by agency practice? Does the process used to address potential large environmental damages from pipeline leaks, ruptures and accidents fully inform the PUC Commissioners prior to their decisions?

4) Are PUC and Commerce agency staff, and the ALJ, fully capable of making decisions on a major state environmental permit when they do not have technical staff; and do they properly rely on agencies such as the MPCA and DNR as indicated by the MEPA law?

VIII.B. Type of environmental reviews for pipelines undefined in PUC rules. Neither the CN rules nor Route Permit rules actually define the type of environmental review documents needed for pipelines as do the MEQB rules and guidance documents. Therefore they provide poor guidance to applicants and the public, especially considering the magnitude of the decisions on large oil facilities such as a pipeline.

1. *Certificate of Need (CN.)* The CN rules clearly indicate that environmental criteria are an important part of the decision as to whether a CN should be issued, and also include rules requiring the applicant for a pipeline CN to provide environmental information. As indicated in my testimony, previous testimony indicated the CN is subject to MEQB regulations separate from the Route Permit. But the CON rules don't provide guidance as to how the necessary information is to be developed and used, nor is there guidance regarding fulfilling MEPA requirements.

2. *Pipeline Route Permit*. The rules refer to a "comparative environmental analysis" being done for the alternate routes. But this term is undefined. It has become known as the CEA. Compare this to the MEQB ER rules: the EAW and EIS documents are exhaustively defined, and the MEQB prepares helpful guides that further explain what is expected. The law establishing this Permit indicates that the environmental studies done for the permit substitute for an EIS or EAW, and the MEQB did approve the rules as substituting for environmental review (in 1989.) However, there is no evidence that the intent was to reduce the responsibility for the PUC and Commerce to comply with MEPA principles and purposes

3. *Overreliance on applicant's environmental documentation*. In the past, for example, DOC relied on Enbridge's deficient environmental documentation for its very large Alberta Clipper and Southern Lights projects. Additionally, PUC and DOC staff have been reluctant to comply with DNR requests to place permit conditions on the Route Permit based on their detailed analysis of environmental impacts. Instead, DOC staff have relied on negotiating changes in the pipeline company's environmental mitigation plans, and have issued Route Permits that closely resembles such plans. This is not in compliance with MEPA directives for interagency coordination, and in recognition of agency expertise regarding natural resources. Such past practices have thus had a strong tendency to reduce the scope of the impact discussion to only those topics covered by the company plan.

VIII.C. Complex CN and Route Permit procedures interferes with necessary public participation. Both the CN and Pipeline Route Permit proceedings are conducted under an administrative hearing process. Such a process is legalistic, difficult to understand, and almost hostile to ease of participation by the public when compared with the public participation process used by the MEQB regarding reviews of EAWs and EISs. All one has to do is examine the Commerce and PUC eDocket web site. There are two such eDockets for the Sandpiper project, with very many items listed—*without plain English identifiers as to content in most cases*. One has to open each one to see its relevance, and many are simply legal notices of service, etc.

VIII.D. No ability to review draft ER documents prepared by Commerce except via a complex administrative hearing process. The MEQB has helpful guidance documents that clearly lay out procedures whereby documents are placed before the public for review. Note that in Section III, I have described how, in practice, it has become a given that such review is a major part of the ER process. The CEA (and note it is not defined in the rule) in the Route Permit process is not placed before the public in draft form, as are normal ER documents. In the CN rules, there is no guidance for the public to be able to determine what is being prepared, much less having an opportunity to easily respond to content, other than information placed before the ALJ. There are public hearings where the public can comment, and such comments are placed on the eDocket sites. But there is no clear information on how the comments are used, and whether they are even seen by the ALJ and PUC members.

VIII.E. Staffing for Commerce, PUC, and ALJ severely limited. The staff that handles the CN and Route permit in Commerce and the PUC is small, considering the magnitude of this major Minnesota environmental review. Staff are project coordinators and don't have technical staff to consult within their agency. The ALJ is not a technical person, and has no technical staff, even though the ALJ plays a very prominent role in weighing the evidence prior to making findings which are given to the PUC commissioners. All of these personnel are based in the Twin Cities.

This staffing situation is not similar to staffing for agencies processing other major state environmental permits, such as air quality permits by the PCA or mining permits for the DNR. Commissioners of these agencies have a much larger staff to call upon when major environmental permitting decisions are made, including field staff from all over Minnesota in the geographic areas where projects are proposed.

VIII.F. ALJ not addressing major DNR comments on recent large pipelines. The ALJ on the Alberta Clipper and Southern Lights Enbridge projects did not address multiple DNR comments expressing a high degree of concern for impacts to natural resources in his Findings on these projects. All he said was that the DNR commented. For example, in spite of definitive documentation of a wide ROW in hilly terrain by the DNR, the DOC accepted Enbridge's statement that no additional work space was needed in such terrain. (see PUC Final Route Permit for Alberta Clipper Southern Lights projects Dec 2008, and Appendix 1.)

VIII.G. DNR has very limited direct jurisdiction over natural resources affected by the projects. According to DNR comment letters submitted to the ALJ and Department of Commerce on the Alberta Clipper/Southern Lights projects, the DNR had direct authority over only 0.5% of the project that crossed the entire state of Minnesota. This included all Protected Waters, and all state lands. With respect to Protected Waters, under DNR's License to Cross Procedures recognize DNR jurisdiction only to the top of the bank of rivers, which is the Ordinary High Water mark. For example, at LaSalle Creek, a designated trout stream in Clearwater County, this only constituted about nine feet of jurisdiction on the MinnCan project. Such limited jurisdiction meant that the only avenue for moving the crossing point to a better location was via the Route Permit. The Department of Commerce staff, and ALJ, have declined to insist that this occur, and have deferred to the applicants, especially on the Enbridge projects.

I believe the DNR's Utility Crossing License was originally foreseen to rapidly process the multitude of small utility projects that crossed many Protected Waters. The license appears to be more appropriate for much smaller utility projects and for utility crossings of state lands. Procedures are modelled on the state lands approval process, which is highly legalistic (requiring a detailed permit application before the permit is processed) rather than procedures used for Protected Waters permits, which encourage early coordination with applicants prior to submission of applications.

VIII.H. "Corridor fatigue" not addressed by DOC or PUC in the past. Clearly, MEPA requires a close look at cumulative impacts caused by projects accumulating in one area. The clear purpose of this is to prevent locations to become "sacrifice areas" from projects for which completely independent government decisions occurred, as if the other projects didn't exist. These two Enbridge projects has exposed this past inattention to this part of the law.

VIII.I. PUC and DOC have not addressed operation impacts of oil pipelines. On other projects requiring environmental review, potential impacts during project operations are addressed in the review. This has not happened with oil pipelines, even though operational impacts of other projects in Minnesota subject to MEPA are closely examined during the ER process. The pipeline rules at least imply that such a look is needed.

VIII.J. Recommendation for determining who should be the RGU for the necessary EIS.
In my past employment, I have made recommendations comparable to this policy recommendation. Given the complexity of the issues and the certain complexity of the EIS on the CON proceeding, the MEQB would be a suitable RGU for an EIS. The PUC and DOH are familiar with contested case hearings, especially on energy projects. Such procedures would not be well suited for this EIS. Furthermore, it is likely there will be multiple contracts let for the

necessary work for this EIS. The MEQB can coordinate more easily among its member agencies regarding many of the details that would result in a proper EIS.

APPENDIX 1. APRIL 4, 2014 TESTIMONY OF PAUL STOLEN SUBMITTED TO THE DEPARTMENT OF COMMERCE DURING THE HEARINGS ON THE ROUTE PERMIT.

(Note comment at the end of the cover letter regarding minor corrections.)

April 4, 2014

Paul Stolen
37603 370th Av SE,
Fosston, MN 56542,
218-435-1138

Mr. Larry Hartman
Environmental Review Manager
Minnesota Department of Commerce
85 67th Place East, Suite 500
St. Paul, MN 55101

Re: Comments on proposed Enbridge Sandpiper Pipeline, Minnesota Public Utilities Commission (PUC) Docket #13-474

Dear Mr. Hartman:

Enclosed are my comments on this proposed project. They concern the main topics solicited in the January 31, 2014 public notice. I suggest alternative routes and route segments, and provide answers to public notice questions "What human and environmental impacts should be studied in the comparative environmental analysis?" and "Are there any specific methods to address these impacts that should be studied in the comparative environmental analysis?"

My comments address human and environmental impacts. They identify appropriate methods of studying such impacts, based on PUC rules and standard methods used in Minnesota and elsewhere to review pipelines.

The most important point in these comments concerns the enormous quantity of oil and other hazardous product that is already flowing through multiple pipelines in one or two narrow corridors This project, and the new Line 3 Enbridge replacement and enlargement, will add even larger amounts of oil and product to these corridors. These corridors cross highly valued natural resource areas that have many lakes and clean rivers. They are often at or near the headwaters of drainages and in hilly areas, as well as being close to people and concentrations of residences.

It is time for Minnesota and federal regulatory agencies to address the problem of multiple large diameter pipelines in close proximity to each other. This concentration makes the consequences of a single site event—whether such an event is natural, accidental, or intentional—potentially catastrophic. Furthermore, my comments will show that the flow of oil and other product will be so large as to be larger than—or a significant portion of—the flow of well-known rivers crossed by the corridors.

I am submitting these comments as a citizen but also as an expert. These are my personal comments written without review or reimbursement of any party. I will be willing to provide testimony as such in legal and legislative forums, should this be necessary, depending on personal availability.

In lieu of providing a c.v. at this time, I summarize here my credentials for asserting that I have expertise regarding the Sandpiper review.

I have regulatory experience with large natural gas, carbon dioxide, water, and oil and product pipelines in Montana and Minnesota. This has involved on the order of 10-12 pipeline projects while employed at the Montana Department of Natural Resources and Conservation (DNRC)and the Minnesota Department of Natural Resources(MDNR). In Montana, the DNRC had environmental review, locational approval, and Certificate of Need Authority for energy facilities combined in one agency. I have also supervised, and /or participated in the preparation of EISs or EAs of such pipelines. This included conducting training sessions for other regulatory personnel on how to review pipelines for impacts and on pipeline construction methods.

I have written or coordinated the writing of major environmental review regulations for fixed linear energy facilities, including pipelines and HVTL lines. This experience included reviewing specific proposed linear and fixed large energy facilities (power plants and HVTL lines), and high-level nuclear waste repositories. I have been an environmental inspector on a number of large pipeline projects, including presenting agency views at pre-construction conferences with pipeline builders and sub-contractors.

I have policy-level experience with both federal and state laws and regulations regarding environmental review, pipelines, and solid and hazardous waste topics. This includes legislative staff work, legal depositions, testimony in court, and presentations to other agencies. Finally, this experience also includes years of doing environmental reviews of many other types of projects, including experience with formal risk assessment, and supervising and/or writing scopes of work for the preparation of highly technical studies conducted by outside consultants.

Review and permitting of significant projects such as the Sandpiper project, and the 36-inch Enbridge upgrade of its old Line 3, means that there are overlapping jurisdiction with other federal and state agencies. Some of these are broader than the narrow PUC review requirements. My comments also pertain to those other agency responsibilities. It is necessary to exchange information among such government authorities as a matter of good government. Many of my comments attempt to accomplish such a goal. Therefore, I am providing copies of my comments to these other agencies.

My comments are enclosed. Thank you for consideration of them.

Sincerely,

Paul D. Stolen

C: Tom Landwehr, Commissioner, Minnesota DNR
John Linc Stine, Commissioner, Minnesota PCA
Tamara Cameron, Regulatory Chief, Corps of Engineers
Bob Eleff, Minnesota Legislature, House Research
Ken Westlake, USEPA, Chicago Office
US State Department, Washington DC

NOTE: For the record, this document is not an exact duplicate of that submitted to the Minnesota PUC, since it contains corrections of typographical errors, corrections of acronyms and names, and a couple of minor number corrections of oil flows. It also contains corrections in the numbering of points that were discovered upon further review on October 8 2014.

Comments on proposed Enbridge Sandpiper Pipeline, Minnesota PUC Docket #13-474
Expert Testimony of Paul Stolen, Fosston Minnesota
April 4, 2014

I. Potential oil leaks and pipeline ruptures must be addressed in the route permit, by Minnesota state agencies, and by the US Corps of Engineers and EPA.

Summary: In this section I make the case for using accepted methods of risk assessment to address the consequences of pipeline ruptures to the Minnesota environment and people from this project. A foundation principle of risk assessment is that the greater the consequences of an event, the greater the need to examine rare or unlikely events. There are five reasons why unlikely events need to be considered in this risk assessment for this project:

1) Risk assessment scenarios in Attachment 4 are roughly applicable to one of the existing and proposed pipeline corridors in Minnesota. For example, a 36-inch pipeline rupture of the "worst case" type used in the assessment, may still release on the order of 40,000 barrels of oil, even assuming the quickest reaction time of pipeline operators to close block valves(13 minutes.) If valve closure time is delayed for 30 minutes, this rises to about 70,000 barrels, and if delay is 60 minutes, the amount is 100,000 barrels.

Such releases could have extremely high consequences to the Minnesota environment, and higher releases are possible under some risk assessment scenarios.

2) The portion of the Sandpiper route between Clearbrook and Park Rapids already contains three pipelines. Enbridge is apparently planning one more 36-in line in the same corridor as the 30 inch Sandpiper route. I raise the question as to what "worst-case" scenario should be used when there are 5 pipelines in close proximity in remote areas and at least somewhat susceptible to natural or intentional damage, perhaps to all of them at one time?

3) The corridor Enbridge proposes to use traverses a landscape rich in aquatic and other natural resources, highly valued by Minnesotans, and that includes major groundwater resources.

4) The portion of the Sandpiper route between Clearbrook and Park Rapids was fraught with problems during construction of the MinnCan pipeline, which were at least partially due to the corridor being created for a small pipeline long before modern environmental laws were passed.

5) The other route likely to be considered in the Sandpiper comparative review—the Enbridge mainline corridor—suffers from very similar problems as do at least the first three listed above. There are already as much as 7 pipelines present in this corridor.

The Sandpiper project, as well as other new projects in the planning stages, will add significantly to the enormous quantity of oil and other hazardous product that is already flowing through two narrow pipeline corridors.

It is time for Minnesota and federal regulatory agencies to address this problem of multiple large diameter pipelines in close proximity to each other. This concentration makes them vulnerable to natural events, accident or intentional act—such as the Oklahoma City federal building bombing. In fact, in Comment II.A. I discuss a specific case on the Alberta Clipper route where very high flows caused by the large rainfall events that seem to be caused by global warming could threaten the integrity of more than one of the large pipelines in this narrow corridor.

My comments on this topic are based on my experience with pipelines in Minnesota and Montana, as well as with exposure to risk assessment concepts and methods. Enbridge may object to the use of the ORNL study in Attachment 4, and say it is not appropriate to apply to these projects. I disagree: of course it isn't directly applicable, but its methods are modifiable so that it is. Extrapolating the findings of Attachment 4 to the two corridors could be pushing things a little—but I have found no information that anyone else is considering these issues and the deadline for PUC comment is now due. It is therefore entirely appropriate to use it, and I hope to trigger a helpful debate. And, I know for certain that this topic is important and should be shared with the public.

The jurisdiction of the PUC and other Minnesota agencies regarding the scope of review as it pertains to pipeline design and location lacks clarity that contributes to confusion among regulators as well as the pipeline company personnel. This is related to the issue of pipeline "safety standards", and is discussed in detail in Comment II below. This lack of clarity and confusion should not be allowed to continue, since in my view, Minnesota's natural resources and citizens are threatened by rare but reasonably foreseeable events.

As noted in Comment II, I believe the evidence is firm that Minnesota state agencies can effectively develop measures regarding mandatory design features related to pipeline ruptures and leaks in order to that protect people and the environment without encroaching on federal "safety standards." Such involvement is extremely important, given the magnitude of oil and product potentially moving through these corridors.

<u>I. A. Estimates of existing and proposed pipeline oil and product flows in Minnesota as compared to selected river flows</u>.

After burial, pipelines, when functioning correctly, are largely invisible to the public and most policy makers—such as those currently concerned with oil transport by rail. In order to make considered judgment on policy and permits—as well as allowing proper public involvement—this needs to change. It is no longer acceptable to have an "out of sight, out of mind" attitude on the magnitude of current and potential oil transport through Minnesota in restricted corridors with multiple pipelines.

It is not possible to begin to analyze potential impacts from pipeline leaks and ruptures without knowing amounts of oil and product being transported. Attachment 1Aprovides details about oil flow into and through Minnesota in the corridors relevant to the Sandpiper analysis. It thus provides a basis for analyzing socio-economic, public safety, and environmental impacts from leaks and ruptures. Pipe size and amounts of oil and product pumped are given, as is ownership and origin (for most of the lines.) Attachment 2 provides a description of most of the Enbridge pipelines.

Also included on page 3 of Attachment 1 is a comparison of pipeline oil and product flow and selected river flows near where corridors cross the named rivers. These data, while in cubic feet per second (cfs), are useful for both public understanding of local residents as well as resource managers. The public in these locations can at least visualize the rivers even though most do not directly understand cfs figures.

The river flow data shown are long-term median flows for April 2, not current flows. Therefore, they are indicative of long-term spring runoff conditions, and are likely substantially higher than low-flow conditions. In addition, the percentages comparing oil/product flow to river flow use the highest amounts based on the proposed pipeline projects in the permitting and planning stages.

There are some caveats with respect to the numbers in Attachment 1. First, I used reliable sources for the numbers. When I used news reports, I only used those where pipeline companies were directly quoted, and checked multiple news sources. However, the amounts indicated for the Minnesota Pipeline Company older lines rely on indirect conclusions based on Citation #2 figures and subtracting known amounts from specific projects. The Enbridge figures for existing pipelines in its Mainline corridor are taken directly from them. (Attachment 2) Finally, the source of oil/product was somewhat difficult to determine in some cases.

Attachment 1 indicates the following with respect to comparison of April 2 long-term median river flows with oil flow amounts in pipelines, both expressed in cubic feet per second:

--Four of the listed rivers, Snake River above Warren, Clearwater river at Plummer, Straight River at Park Rapids, and Prairie River at Taconite, have oil/product flows substantially higher than current spring flows in the rivers. In one case oil flow is 200 percent of water flow.

--In all cases, especially if one considers large releases during higher flow conditions resulting in rapid dispersion downstream, these rivers are important and sensitive natural resources. For instance, the Straight River south of Park Rapids is a nationally recognized brown trout fishery.

I.B. Methods of determining socio-economic and environmental impacts of pipeline ruptures

The PUC public notice on Sandpiper requested advice on methods of addressing potential impacts. There are indeed methods already in place, such as:

I.B.1. *Identification of "High Consequence Areas.(HCA)"* Comment II.B.1. addresses this topic in detail and provides recommendations for how to use this category in the project review. These areas are also roughly described in the federal agency-prepared Attachment 3, which includes somewhat useful guidance as to their possible use in the Sandpiper project.

I.B.2. *Risk Assessment with respect to potential amounts of oil/product released by ruptures.* A foundation principle of risk assessment is that the greater the consequences of an event, the greater the need to examine rare or unlikely events in the risk assessment. Attachment 4 is a clear illustration of this principle. For example, it indicates that a "worst-case" pipeline rupture needs to be used, and justifies why it is needed. Such a rupture is called a "guillotine" rupture : "Guillotine-type breaks are less common than other pipeline breaks such as fish-mouth type openings, but they can occur as a result of different causes including landslides, earthquakes, soil subsidence, soil erosion (e.g. scour in a river) and third-party damage. The guillotine-type break is the largest possible break and is therefore considered in this study as the worst case scenario. " (page 6 .)

The study goes on to use this scenario in its analysis of the cost-effectiveness of installing block valves, as well as assessing (some) environmental and socio-economic damages from ruptures. It calculates hypothetical releases in different scenarios in its appendix, including those figures listed in the above summary. More detail is provided in the verbatim (except for underlining) excerpts in Attachment 4.

As noted in the above summary, the estimates of amounts spilled from "guillotine" type ruptures of just one pipeline are large—perhaps a minimum of 40,000 barrels from a 36-inch line. Magnify this by the scenario of intentional serious efforts to damage several pipelines at one time—and this amount becomes potentially massive.

I.B.3. Actual damages from recent spills associated with rivers. Attachment 4 also describes two case studies of actual spills. (p. -11.) These two case studies were used to develop a factor to increase the estimated costs according to the Attachment 4 methods by a factor of two, since both found the risk assessment method underestimated actual costs by about 50%.

a. *Enbridge spill into Talmadge Creek and the Kalamazoo River in Michigan*. Approximately 20,000 barrels of oil were released in 2010. The cost of that spill from a 30-inch diameter pipeline was $767 million.

b. *ExxonMobil Pipeline company rupture under the bed of the Yellowstone River 20 miles upstream of Billings, Montana*. This was caused by scour from flooding that exposed and fractured the pipeline that was trenched under the river bed. An estimated 1,509 barrels of oil were released before the pipeline was closed in 2011. Clean-up and recovery costs were $135 million. (Recent news reports indicate final costs and fines are not yet resolved.)

I.B.4. *Comparison of pipeline flow rates compared to river flows.* Attachment 1 indicates total amounts of oil/product flows in the numerous pipelines that cross these rivers. They portray possible amounts subject to the most catastrophic possible pipeline rupture event—that of an event that caused damage severe enough to rupture more than one pipeline. Some of these lines have been trenched under these rivers, in other cases they have been bored so that burial is deep and not subject to certain kinds of rupture events. Damage could conceivably occur due to river scour from unusually large flood events, or from an outside party successfully and deliberately accomplishing such a rupture.

My intent in comparing river flows to oil flows is not to imply that the worst-possible event be used in an analysis. Rather, it is to portray the magnitude of the oil/product flows in terms the public and reviewers can understand. Again, I am responding to normal methods of conducting risk assessments: Very high consequences deserve be paired with rare events. The possible use of this information in any kind of corridor analysis or spill magnitude is subject to a number of questions being answered first. This is discussed next.

I.C. <u>Recommendations regarding pipeline rupture for analysis of impacts, corridor/route comparison, and estimates of spill magnitude based on risk assessment.</u>

I.C.1. *The Sandpiper project should be analyzed with respect to potential impacts from pipeline rupture using risk assessment methods modified from those used in Attachment 4.* This would:

a. Entail determining Enbridge's methods for locating such valves on the Sandpiper pipeline, and making this available for critical review, and

b. Include both estimates of spill magnitude based on ideal block valve locations and rupture scenarios, such as the "guillotine" scenario, and differential valve response times.

c. Estimate the spill magnitude (in a range of minimum spill to somewhat longer response time spills) that then should then be used to assess socio-economic and environmental impact along the existing corridor.

d. The risk assessment should take into account the larger rainfall events in recent years possibly caused by global warming, including an assessment of the possibility of increased scouring in rivers crossed by these corridors.

I.C.2. *What is the "worst case" when multiple pipelines are in close proximity to use in the risk assessment*? "A review should be undertaken to determine the proper "worst-case" rupture scenario when multiple pipelines are packed close together in a corridor. This should include:

a. An assessment of whether a "worst-case" rupture on one line threatens rupture of another line, such as a large fire.

b. An assessment of whether the response to a "worst case" event on one line is slowed by the presence of other lines either on one or both sides of the ruptured line because equipment can't cross the shallowly buried other lines. This should also include a description of circumstances where all or some lines still operating need to be shut-down during the response and the

practicality of doing so. (It needs to be recognized that in some locations there are "cross-overs" where one line is constructed underneath other lines because of existing facilities on one side—such as railroad tracks—prevent construction on the preferred side.)

c. Consultation with state and federal pipeline authorities as well as the authors of the Attachment 4 study as to what constitutes "worst-case" ruptures when there are multiple lines in close proximity.

d. Consultation with the Attachment 4 authors and others regarding the vulnerability of a corridor with multiple large pipelines in close proximity to deliberate actions and how this should be addressed in socio-economic and environmental impact reviews.

I.C.3. *A process is needed whereby problems found during review of additional pipelines in any given corridor that might threaten pipeline integrity are thoroughly reviewed by government personnel*. While perhaps outside the scope of the PUC Sandpiper review, procedures should be developed whereby state agency field staff who find potential problems at significant pipeline locations could be assured that the problems are adequately responded to by government agencies rather than pipeline owners. I have personal knowledge of three such locations along these corridors, as discussed in Comment II.A below.

II. The PUC and Minnesota agencies indeed have significant jurisdiction over pipeline design issues related to oil spills and leaks and site-specific measures to prevent them.

II.A. Overview and significance of the problem. This is an important issue because a properly *designed and located* pipeline can result in the least amount of impact and be a safe way to transport petroleum products.

The central issue is that there is both federal and state jurisdiction and authority, and that it overlaps to some extent. In these comments I maintain that the PUC has clear authority to influence both pipeline *design* and location with respect to analyzing and mitigating impacts to people and the environment.

Minnesota Department of Natural Resources (MDNR) and Minnesota Pollution Control Agency (MPCA) field staff often have intimate knowledge of site specific conditions along pipeline corridors, and are trained to have such knowledge. Yet some pipeline companies, their consultants, and even some people in Minnesota government try to claim that pipeline *design* is solely the bailiwick of federal agencies and federal standards because such design pertains only to "safety standards."

On several occasions during my employment with the MDNR, and while working with other field staff, when we suggested site-specific changes in design that would add more resource protection or mitigation, "pipeline safety standards" were invoked. This was strongly prevalent when MDNR was trying to determine how block valve locations were selected, and why specific block valve recommendations weren't followed.

Other issues involved lack of clarity as to Minnesota Office of Pipeline Safety responsibilities regarding possible environmental damage at locations where pipe integrity was threatened. For example, during one review of the MinnCan pipeline, MDNR staff (Fisheries and Ecological Resources) found a location at a proposed river crossing where a large tree had fallen into the river. This resulted in bottom scour exposing one of the older pipelines. Company officials were not interested, and indicated it was not in MDNR jurisdiction to solve this problem. A call to the State Office of Pipeline Safety only elicited a question as to whether it was brought to the attention of the pipeline company.

On another occasion during the Alberta Clipper review, an older pipeline was found to be hanging a foot or two over the surface of a designated trout stream east of Bemidji. A call to the Minnesota Office of Pipeline Safety elicited a statement that it was up to the pipeline company to correct the problem. This was likely Enbridge Line 1 because of its small size. (See Attachment 2 for a description.)

The most serious problem occurred on the Alberta Clipper route on a Grant Creek crossing just west of Bemidji. I was directly involved in this site, and provided several written documentations as to what occurred. At this site, Grant Creek flows south through a narrow gap in an old railroad grade. Upstream of this gap Grant Creek flows through a large expanse of wetland. The creek is also subject to numerous beaver dams upstream. The railroad bridge at this site had collapsed into the gap, which was also filled with segments of a five foot concrete culvert.

Immediately below the gap are 5 or 6 large pipelines, with the first being within just a few feet of the steep railroad grade. Grant Creek then takes sharp turn to the east, actually following the pipeline in a parallel manner, until again turning south where it flows over the trenched pipes. I observed that bank erosion had removed 6 or 7 feet of the bank, and that this had all occurred since the previous summer. Therefore, this large pipeline was now only protected by about 5 feet of riverbank.

A large and rare rainfall event in the drainage above this site would have taken out beaver dams, and added to the flow through this narrow gap. It is likely that the first pipeline would have easily been exposed. In addition, the heavy concrete sections could have been eroded into the pipelines, threatening ruptures. Enbridge wanted to do something off the right of way in this location to "clean up" the site. They asked for my advice regarding permitting and repair. Since there were concrete sections available, and it looked as if there was a pipeline integrity issue present, I supplied the advice on armoring the eroding bank next to the pipeline, and moving the bank farther from the pipe. This was done by driving the 5 foot concrete sections into the stream bank, a technique I had learned while employed at the DNR. I documented that this was a temporary solution

This site should be thoroughly assessed for susceptibility to scour—since it is an ideal site for down- cutting caused by human activity restricting the floodplain of this river. On several other occasions, when MDNR staff found exposed pipe on older—and large—pipelines in sensitive areas next to rivers, the same thing happened—staff were told it was up the pipeline company to fix the problem.

II.B. Specific PUC rules on "safety standards." The PUC rules for the route permit, in 7852.0200, Subp. 2 "Scope," has two sentences containing language pertaining to pipeline safety standards. In fact, the language is so similar as to be almost redundant:

--Second sentence: "This chapter does not set safety standards for pipelines."

--Last sentence: "The (permit) must not contravene applicable state or federal jurisdiction, rules, or regulations that govern safety standards for pipelines nor shall the permit set safety standards for the design or construction of pipelines."

I submit that the State of Minnesota has a number of clear ways it can influence Sandpiper (and any other liquid pipeline) without "setting safety standards." These are as follows:

II.B.1. Location of High Consequence Areas (HCA) is not necessarily only a "safety standard." These areas are referred to in federal safety standards for pipelines. They are areas where ". . .a release could have the most significant and adverse impact." Attachment 3 provides lots of detail concerning both human and ecologically important areas, such as "land area in which spilled liquids could affect the water supply……critically imperiled species…..areas where migratory birds congregate…..(pipelines) that pass near enough that a release could reach the area by flow over land or within a river, stream, lake, or other means, are assumed to affect (the HCA.)"

Strangely, this document doesn't mention an HCA identified by state authorities, but actually refers pipeline operators to Nature Conservancy personnel to be consulted on important areas. (A personal comment here: Might this not imply a rather over-reaching and likely unconstitutional claim of federal legal authority?)

In addition, while I was employed by the Minnesota MDNR, we had a meeting with the Minnesota Office of Pipeline Safety regarding issues along the MinnCan route. The people we met with never mentioned the concept of HCAs. They were not familiar with or interested in site-specific environmental issues, in fact, and only referred to specific generic safety standards.

II.B.2. Recommendations to reduce confusion and lack of clarity among agencies with overlapping responsibilities.

a. PUC, MDNR, BWSR and MPCA staff consult the Minnesota Attorney General's Office to investigate the specific federal rules pertaining to HCA's to determine the ability of state authority to identify and influence the identification of both project-specific HCAs and more permanent HCAs. Examples of state-identified areas should include groundwater recharge zones, designated trout streams, canoe routes, rivers with significant fisheries or rivers leading to significant fisheries or drinking water supplies, and a number of others.

b. PUC, MDNR, BWSR, and MPCA should notify the federal Office of Pipeline Safety that Minnesota intends to actively propose additions to the National Pipeline Mapping System referred to in Attachment 3, based on the review of the Sandpiper proposal as well as the other

Enbridge and Minnesota Pipeline company expansion plans. This should include the corridors identified in Attachment 1 as well as any other corridors and new pipelines.

c. The environmental analysis of the Sandpiper and alternatives identify HCAs along all alternative routes, including already-identified HCAs and ones identified by the public, Minnesota MDNR, MPCA, BWSR, and federal COE during this pipeline review. The outside consultant hired by the PUC to do the analysis of impacts and the route comparison should be charged with consulting and coordinating with Minnesota state agencies to identify these areas. The route comparisons should then include these locations in the analysis.

d. Extra care should be taken in the identification of HCAs along any corridor with multiple pipelines because of the increased magnitude of possible ruptures affecting a wider area than normal for one pipeline.

II.C. Pipeline design features that protect people and the environment are site-specific and thus need site-specific design features. It should not be necessary to have to make this point because we are many years past such knowledge-based standard techniques for assessing impacts and mitigating them. Almost every environmental permit given has site-specific measures.

Large-impact projects always should have site-specific design. In fact, well-designed pipeline projects when they are finally ready to be constructed uses something often called a "line list" which identifies down to the foot what environmental mitigation measures are to be used in sensitive locations.

II. D. Support for my contention that pipeline design features such as some block valve locations are not always a "safety standards" issue. The following information clearly supports this contention:

II.D.1. Citation 8 (Attachment 4). Block valves and other related design features work to rapidly shut down and isolate pipeline segments when a sudden pressure drop indicates a pipeline rupture of enough magnitude to trigger the designated pressure drop. They can either be manual valves or remotely-operated valves.

Attachment 4 is a recent (late 2012) major study regarding improving block valve usage to reduce releases of large amounts of hazardous liquids. This was done under the auspices of an internationally known energy research institution, the Oak Ridge National Laboratory. The instigation for this study was primarily driven by the natural gas pipeline explosion in California that killed 8 people, but also seems likely that it was influenced by the large Enbridge rupture in Michigan, since it uses both as case studies. This document illustrates why features such as block valves are clearly not always a "safety standard." Here are quotes relevant to site specific pipeline design that are not "safety standards."

".. . ..site-specific parameters that influence risk analyses and feasibility evaluations often vary significantly from one pipeline segment to another and may not be consistent with those considered in this study. Consequently, the technical, operational, and economic feasibility and

potential cost benefits . . . . . .need to be evaluated on a case-by-case basis." (p. 1 of Attachment 4.)(emphasis added)

"Section 4 of the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 calls for the Secretary of the U.S. Department of Transportation (DOT) to require by regulation the use of automatic or remotely controlled shutoff valves, or equivalent technology, where it is economically, technically, and operationally feasible on hazardous liquid and natural gas transmission pipeline facilities constructed or entirely replaced after the final rule was issued. . . . .The Act also requires a study to discuss the ability of transmission pipeline facility operators to respond to a hazardous liquid or natural gas release from a pipeline segment located in a high consequence area (HCA)." (p. 1 of attachment 4)

"In addition, operators are required to consider installing emergency flow restricting devices such as check valves and RCVs on pipeline segments to protect a HCA in the event of a hazardous liquid pipeline release. In making this determination, an operator must, at least, consider the swiftness of leak detection and pipeline shut down capabilities and benefits expected by reducing the spill size." (p. 2 attachment 4)

II.D.2. Citation 9. This engineering study, entitled "Method determines valve automation for remote pipelines," describes methods of determining where automated block valves are to be located. The method is clearly based on site-specific design features. In addition, the following quote summarizes how block valve location is not directly based on "safety standards":

"Most pipeline codes do not stipulate requirements for block valve spacing or remote pipeline valve operations along transmission pipelines carrying low-vapor-pressure petroleum products. This requirement is generally industry driven to control hazards and reduce environmental effects of pipeline ruptures or failures causing hydrocarbon spills. . . . . This article summarizes pipeline codes for valve spacing and spill limitations in high consequence areas (HCAs). It also provides a criterion for an acceptable oil spill volume caused by pipeline leak or full rupture. The criterion is based on industry's best practice." (Introduction to the study.)

Note: This study noted at the end that the acceptable spill volume used to determine the valve spacing was about 20,000 barrels of oil. The study was done for several large pipelines in Brazil. I did not attempt to decipher the meaning of that large amount being acceptable for design of block valve location.

II.D.3. Recommendations for Sandpiper review and analysis regarding block valve locations.

a. Enbridge be required to clearly describe their method of determining block valve determinations, including identifying what HCAs they used, as well as any other factors for determining such locations, including cost factors and "minimum acceptable leaks." This information should be submitted to the MPCA, MDNR, and COE in time for them to respond appropriately, and in time for incorporation into the analysis of impacts and Comparative Route Assessment.

b. MDNR, MPCA, and/or PUC (and COE) should request information from the Office of Pipeline Safety as to whether they have provided any advice to Enbridge for determining block valve locations and acceptable minimum amounts of oil at HCA locations, potential HCA locations, and other-than HCA locations, including cost-factors.

c. Minnesota state agencies and the Corps of Engineers develop a cooperative and partnership relationship regarding the potential socio-economic and environmental risks of having multiple large pipelines in close proximity to each other.

III. The PUC, other Minnesota agencies, and the US Corps of Engineers and EPA must address "corridor fatigue."

PUC pipeline rules favor following existing corridors—even when the pipelines are squeezed into environmentally and socially sensitive areas. The current rules also allow pipeline companies to use the rules to their benefit and to reduce the scope of the analysis. Clearly, this needs a legislative solution. However, there are methods that can be used in the Sandpiper review that are within the current rules that can attempt to get at the "corridor fatigue" problem. I provide some detail in these comments because of the importance of this issue. My recommendations as to how to handle this in the Sandpiper review are in III.C. below.

III.A. Background. "Corridor fatigue" is a term that has been used to talk about what happens when multiple linear facilities such as pipelines and High Voltage Power Lines reach a point where cumulative impacts, objections from people nearby, and crowding of various sensitive areas along the edge of corridors began to be more and more apparent.

In fact, this term is inappropriate with respect to the pipeline corridors described in Attachment 1. Much more proper terms are "corridor sickness" or "corridor exhaustion."

Any resource manager with experience in environmental review of linear facilities in Minnesota (or elsewhere) knows the reasons that lead to overuse of corridors. Some of these are generic, and others are specifically relevant to the Sandpiper proposal. These are:

III.A. 1. *Original linear facility routes pre-date almost all environmental laws.* This meant the route went through high-impact locations that wouldn't otherwise be crossed under current laws and regulations. Essentially, these routes were the shortest distance between endpoints unless there were prohibitive obstacles in effect at the time of building. These original facilities were usually small pipelines. This is true of both the Enbridge Mainline corridor and the Minnesota Pipeline Corridor.

III.A.2. *Each additional facility was assessed independent of others.* Methodology to fairly assess cumulative impact of additional facilities after the second facility was usually not used. (It is often the third facility that starts to show the strain.)

III.A.3. *Large linear facilities are almost always controversial.* There was strong pressure to follow existing corridors. This then became embedded more and more strongly in either

informal or formal policy, and finally made it into regulations. Unfortunately, when this was done, there was no concurrent regulation requiring an objective assessment of the pros and cons.

III.A.4. *Lack of appropriate regulations.* Policy-makers formalizing existing corridor locations as the most likely place to put new facilities didn't write corresponding policies that required a look at impacts of ever-larger corridors. Likely the best example of this I know of is the LaSalle Creek valley north of Itasca Park on the Minnesota Pipeline Corridor. This site is covered in detail below.

III.A.5. *Citizens living next to corridors have little recourse to challenge expanding corridors, since the energy companies and PUC are essentially in agreement for all practical purposes*. The PUC has not developed objective methodology to address this major problem. The result is that adjacent landowners are subject to the highest impact.

III. B. Known potential impacts of enlarging Minnesota Pipeline and Enbridge mainline corridors because of previous recent reviews. There are recent reviews of both of these corridors (except for the Sandpiper Greenfield route.) Therefore, these reviews, including comments of agencies with responsibilities for environmental protection, are relevant to the current reviews.

II.B.1. PUC, MDNR,MPCA, and COE review of the MinnCan pipeline. During the review process for the MinnCan pipeline, there were many issues raised by agencies with natural resource, wetland, and permitting authority. There was an important ALJ report prepared for this project. All of this is available in the PUC records for this project. There were also major problems identified during construction. The review of that project is recent enough so that environmental concerns raised are still relevant.

III.B.2. PUC, MDNR,PCA, and COE review of the Alberta Clipper/Southern Lights/LSr projects. Even more recently, the Enbridge Line 3 expansion proposal follows its mainline corridor to Clearbrook and on to Superior or the problematic corridor south of Clearbrook. An alternative route to Sandpiper follows the Mainline corridor on to Superior. The current reviews involve the same corridors recently reviewed.

III.C. Route width for new reviews too restricted so that it exacerbates corridor fatigue. The PUC rules allow Enbridge to select the route width for their application. The rules state a route can be as narrow as the right- of-way required to construct the pipeline, and as wide as 1.25 miles. An examination of the Enbridge proposal indicates in many locations that Enbridge has selected a very narrow route width. It is obvious that the narrower the route width for this review along the existing Minnesota Pipeline Corridor, the more advantageous to Enbridge—because it becomes too late to adjust the right of way to avoid impacts found after finalization of the route width by the PUC.

Generally speaking, the PUC waits for others to object to this restrictive situation and propose enlargements, or other route segments or routes.

A good example concerns river and flood plain crossings. Normally, the clear standard for crossing of such environmentally sensitive features with linear facilities is perpendicular to the

floodplain, and perpendicular to the river meander. In addition, as mentioned in Comment V, the MDNR does not have permit jurisdiction beyond the Ordinary High Water of the river or stream (this is the top of the bank in most cases.) The DNR has two options for influencing this—proposing a route segment change or widening, or relying on the PUC authority to require moving the centerline. Furthermore, DNR often indicates to applicants to begin preparing detailed applications for its license to cross before the environmental analysis of routes is completed.

In other areas, the 1.25 mile width is still too narrow to address the problems of pipeline corridors expanding more and more in high-impact areas.

III. D. LaSalle Creek problem area. More than any other location, this area epitomizes the landscape and regulatory issues of "corridor fatigue" and problems of following old straight-line routes. The crossing and surrounding landscape has the following characteristics:

--This location is not far north of Itasca park in a heavily forested area with steep and convoluted glacial moraine. LaSalle Creek itself is a small designated trout stream flowing in a glacial tunnel valley toward LaSalle Lake. The stream channel is deeply incised in the wetland with many meanders. Right at the crossing point, the stream and valley narrow upstream but widens out substantially downstream toward the lake. The ridges on either side of the tunnel valley are likely more than 100 feet higher than the stream.

--The existing Minnesota Pipeline Company pipelines traverse the valley at the almost the worst possible manner: a sharp oblique angle side-hilling down portions of the west hillside from the north, then side-hilling out of the valley on the east side after crossing the creek.

III.D.1. *Severe problems with the MinnCan crossing*. There were severe and numerous problems with this area. I am supplying some detail on these problems because I am proposing a re-route around this area several miles in length. The problems are as follows.

a. MDNR sent an "early-coordination" letter to the MinnCan consultant warning that this crossing was the worst site of all the locations in the Bemidji Region portion of the project. There was no response from MinnCan, and near-failure months later for MinnCan to even acknowledge such a letter. By then the PUC process had proceeded past the point for the MDNR to effectively examine another route in this high-resource area.

b. The two old and small pipelines were closely followed with the 24-inch MinnCan line with close separation, on the order of 40 feet if I recall. The old cleared right-of- way was fairly narrow. This greatly expanded during construction. MDNR measured a cleared right of way over 350 feet wide on the north end of the valley. (This was necessitated by the large amount of earth moving required to construct a 50-foot wide level construction word pad.) Topsoil was generally not separated here either, so impacts are long-term.

c. MinnCan did a directionally bore deep under LaSalle Creek. It was somewhat over 3,000 feet in length and done in the winter. As they bored under the creek itself, there was a large frac-out into the creek. (See III.C.3.a) Drilling mud escaped from several other locations besides the

creek bed, all characterized by obvious groundwater upwelling. (In spite of the very cold temperatures the ground and wetland surface was not frozen.)

Construction stopped and clean-up was complicated and protracted. Because of the lack of frost from groundwater upwelling, it was impossible to get equipment to the frac-out sites so that most work was done by hand.

However, it was necessary to get some equipment to the site, which was a very delicate operation because of the deep, soft, water saturated organic muck at the site. There were two existing pipelines floating in this water saturated muck near the surface. These could have been threatened by heavy equipment tipping into this area. Oil/ product flow was *not* shut off during these operations taking place a few feet from the pipes.

d. A large beaver dam downstream of the crossing had backed up water right to the crossing point, and covered parts of the creek receiving drilling mud. In other words, there was thin ice over the flooded creek channel. This obscured drilling mud material and caused safety problems in minus 15 degree weather.

III.D.2. Current Enbridge plans at this site. According to maps I examined during the public meeting at Clearbrook, Enbridge is now planning a warm weather crossing of the creek itself downstream from the existing crossing out in the broader wetland that leads to LaSalle Lake. The proposed crossing location is at a more perpendicular angle to the creek itself but not perpendicular to the valley, since the centerline of the pipe makes a sharp bend after coming down into the valley from the north. After the creek crossing, the Enbridge plan is to open up a new cleared right-of-way on the east side-hill of the valley. This plan was confirmed to me by MDNR staff. Enbridge had indicated to them they would accomplish the trenched crossing in a very short time to reduce impacts. I believe this is a very bad idea for the following reasons:

a. There is wetland along much of this centerline proposal, including as the centerline comes down the hill from the north. There are wetlands on the slopes of the west hill side caused by abundant groundwater emergence. There is deep muck in this area, as well as out in the flat valley. Trenching through this soft area will require very large amounts of construction mats which usually require firmer wetland soils than are present. Furthermore, trying to trench in such an area will result in slumping and the necessity of removing large amounts of material.

b. I have been involved in several wetland situations with some similarities to this site—but not such a large, problematic area as this. None of them approach the red flags of this area. The nature of the muck soil and substrate in the other areas meant that sheet pile had to be driven in on both sides of the trench in order to remove enough material to sink a weighted pipeline. I estimate that more than 1/4 mile of wetland is involved. Furthermore, both ends of this wetland traverse are on inclined wetland at the bottom of slopes. Attempting to excavate a temporary trench through such a location could also easily open a channel so that unpredictable amounts of silt laden water—both groundwater and surface water—flows down the channel into LaSalle Creek.

c. The new right of way on the east side of the valley will also traverse groundwater emergent areas some distance before it rises far enough out of the valley to rejoin the corridor south some distance. This is also an additional impact of such a crossing.

d. I recommend that a route around LaSalle Creek and its valley be considered (see below.)

III.E. Recommendations to begin to address "corridor fatigue" concerns relative to existing corridors followed by Sandpiper.

II.E.1. *Federal EIS on Sandpiper.* The US Corps of Engineers should prepare a federal environmental impact statement for the Sandpiper project. The COE should do this for additional reasons beyond this topic, which will be contained in a separate recommendation to them.

It is clear that the PUC environmental analysis falls far short of what can be explored in an EIS. Nevertheless, Minnesota law says that the environmental analysis done by the PUC fulfils state environmental review requirements.

However, the MPCA and MDNR, who are more familiar with the merits of EIS review than is the PUC, should certainly recommend to the COE that an EIS be done on this project.

III.E.2. *Incorporation by reference of the previous environmental analysis in these corridors*. I hereby incorporate by reference the PUC record of Alberta Clipper, LSr, Southern Lights and MinnCan projects into this Sandpiper review by the PUC. This should jump-start the review of "corridor fatigue" problems.

Examples of relevant documents for these four projects include:

--The ALJ report son MinnCan and the Enbridge projects
--All MPCA and MDNR comments on the projects. There should be special focus on the MDNR objections to detailed and extensive comments that were ignored in ALJ findings.
--All key determinations of the US COE on all projects, and all comments on the 404 notices for the projects

III.E.3. *Any records of specific unforeseen problems and impacts that developed post-permitting on these projects.* If the records cannot be found, these topics should be addressed in the environmental analysis:

a. "Frac-outs" on the MinnCan project. Frac-out is the common term for when drilling mud escapes from the bore from directionally drilled crossings, whether they be short or deep bores. Generally, this becomes evident by mud appearing on the surface or in water bodies. There were a large number of such events on the MinnCan project, and some amounts were very large. These occurred in or next to the following rivers north of the point where the Sandpiper route turns east: Clearwater River floodplain east of Bagley, Mississippi River at the crossing north of Itasca park, LaSalle Creek floodplain and creek bottom north of Itasca Park, and the Straight

river just south of Park rapids. There were other frac-outs south of Park Rapids beyond the point where Sandpiper turns east on a Greenfield route.

Some Frac-outs occurred during winter bores, which greatly increased the difficulty with addressing them for several reasons. Determining amount and location of material was obstructed by ice. Recovery of material was difficult due to ice. Finally, ice conditions on flowing water were a hazard to workers attempting to recover material.

All records of frac-outs that occurred on MinnCan should be carefully examined as to amounts and locations. This may help to determine if there is a pattern as to when they occur. In each of the four rivers mentioned above, landscape conditions were such that groundwater upwelling zones were either present or suspected at the site of the frac-out. If this is correct, such landscape conditions that are present in other locations are a red flag for bores in the future.

Drilling mud is primarily bentonite clay but contains additives at the discretion of the pipeline company. Additives are a two edged sword: they can increase the success of the bore and reduce frac-outs, but some additives can be toxic to aquatic life. Furthermore, MinnCan initially claimed trade secret status on the first frac-out at the Clearwater river, which became a big obstacle to resolution. Therefore, PUC should require specific listing of any constituents of drilling mud before. Some of the frac-outs were in locations subject to direct DNR permit authority, but others were outside of the OHW so were not. PUC should make it a condition of the Route permit that frac-outs be handled in essentially the same manner wherever they occur, after recommendations from the MDNR and MPCA.

b. *Winter construction successes and problems on MinnCan and Alberta Clipper.* Topsoil separation is important in all areas of deep excavation, including over the trench as well as side-cuts done to prepare the 50-foot level work pad. Poor separation leads to more successful invasive species invasion, and lost productivity. Frozen ground made topsoil separation problematic. In addition, winter construction made it erosion control more difficult and led to substantially higher erosion problems during spring runoff in certain locations.

IV. PUC and Hearing Officer must address concerns of the MDNR regarding natural resources not directly subject to MDNR and MPCA permits.

Environmental impact assessment includes—by law as well as best practice—consideration of impacts not necessarily covered by permits. As noted in a letter to the ALJ on the Alberta Clipper and Southern Lights project, the MDNR said it only had direct jurisdiction on less than 0.5 percent of the route. (April 21, 2008 letter to ALJ Judge Eric Lippman, from Matt Langan, MDNR). This jurisdiction involved public land crossings and river crossings restricted to the OHW (generally the top of the riverbank.)

Subsequently, the MDNR made extensive factually supported comments regarding natural resources in their areas of expertise. Serious problems with Enbridge's data, lack of supporting information, and assessment of impacts were noted. Some of these were glaring errors, such as obvious underestimation of area of impact. The ALJ report finalized its report without discussing the merits of the MDNR comments, and did not address any of them in numerous

findings on the route permit conditions. At the same time, it praised Enbridge's approach. A "reasonable person" perhaps would find it troubling that an ALJ, who lacks natural resource expertise, would replace the expertise of an important state agency, charged by Minnesota law with protecting its natural resources, with that of an energy company with obvious motivations for downplaying impacts to such resources. The lack of attention to the MDNR comments is documented in three subsequent letters to the PUC staff after the ALJ report was finalized (April 25, 2008 letter to Larry Hartman from Matt Langan, MDNR; August 1, 2008 letter to Bill Haar, PUC Executive Director from Matt Langan (MDNR): and November 13, 2008 letter to Larry Hartman from Matt Langan, MNDR.)

Recommendation. The PUC should ensure that this does not happen again, and ensure that the ALJ for this project is charged with specifically making findings regarding potential environmental impacts found to be of concern by state agencies such as the MPCA and MDNR.

V. PUC and ALJ must use accepted impact analysis methods and its own rules to proactively address the Sandpiper project and future even though its environmental report substitutes for an EIS or EA according to law and statute.

V.A. Pipeline rules available to the PUC to improve its responsibility, process ,and results.
Many of the pipeline route permit rules appear on their face to restrict and narrow the environmental analysis as compared to that done under EIS rules and procedures for other large facilities. However, a reading of the rules indicates that the PUC has lots more authority than it used on the Alberta Clipper projects. All of the following rules allow the PUC to address **all** of the topics I have raised in these comments:

V.A.1. Rule "7852.3200, Subpart1: "When the commission issues a pipeline routing permit for the construction of a pipeline and associated facilities, the commission shall designate a route…..conditions for right of way preparation, construction, cleanup, and restoration. . . . **and any other conditions relevant to minimizing environmental and human impact.**" (emphasis added.)

Note: The PUC could have chosen to fully address the MDNR comments that were not addressed on Alberta Clipper using the highlighted language. It now needs to respond to comments by other state agencies on the Sandpiper project and use this clause.

V.A. 2. Rule "7852.0200 Authority, scope, purpose, and objectives

"Subp. 3. Purpose. Minnesota Statutes, section 216G.02, recognizes that pipeline location and
restoration of the affected area after construction is important to citizens and their welfare **and that the**
presence or location of a pipeline may have a significant impact on humans and the environment.
To properly assess and determine the location of a pipeline**, it is necessary to understand the impact**
that a proposed pipeline project will have on the environment. .. .. The purpose of this

chapter is to aid in the selection of a pipeline route and **to aid in the understanding of its impacts and how those impacts may be reduced or mitigated through the preparation and review of information contained in pipeline routing permit applications and environmental review documents**.

Note: The PUC can use this clause to address pipeline rupture risk, corridor fatigue, and so forth.

"Subp. 4. Objectives. The process created by this chapter is designed to:
A. locate proposed pipelines in an orderly manner that minimizes adverse human and environmental impact;
B. provide information **to the project proposer, governmental decision makers, and the public** concerning the primary human and environmental effects of a proposed pipeline project**;**

*Note: Note that this clause contains the phrase "**to** the project proposer. . . .decision makers, and the public" concerning the human and environmental effects of the project. On the Alberta Clipper project, the PUC and ALJ passively turned this phrase entirely on its head and accepted the Enbridge analysis of many issues rather than accept expert analysis from responsible state agencies. This must not happen on the Sandpiper project. The PUC should insist on its role of providing objective information **to** other parties. It should do so on the main topics of these comments.*

V.A. 3. "7852.1400 Route proposal acceptance.

Subp. 2. Sources of route proposals. **The Public Utilities Commission staff and the citizen advisory committee may propose routes or route segments directly to the commission**.

Note: The PUC can use this clause to address corridor fatigue and to attempt to obtain objective comparisons of alternatives to problem locations.

V.A. 4. "7852.1900 Criteria for pipeline route selection.

"I. cumulative potential effects of related or anticipated future pipeline construction; . . ."

Note: The PUC can clearly address the issues of "corridor fatigue" by using this clause.

<u>V.B. PUC can use standard impact assessment methods</u> The statute governing pipelines indicates that the PUC Environmental report meets the requirements of an EIS or EA. However, this does not mean that methods of analysis of impacts do not need to reflect standard methods used in EISs.

The request to the public to propose methods of analysis in the PUC public notice actually is strange. There are effective methods for analyzing impacts to humans and the environment and

methods for comparing routes for linear facilities. These methods have been in effective use for many years. All one needs to do is find an EIS that has done so effectively.

V.C. PUC staff needs to acknowledge the limitations of the pipeline environmental analysis . I was present at the Sandpiper public meeting Clearbrook some weeks ago. A citizen asked how the PUC environmental analysis compared to an EIS. The PUC lead person said it was essentially the same. I was taken aback, as were some others that were present. I was later informed that this same statement was made at the Park Rapids meeting. This is highly concerning since the citizen was misled. It also is concerning because it implies PUC staff is unaware of important and routine methods of analyzing impacts and alternatives in EISs on linear facilities. Such methods are an answer to the question in the Sandpiper public notice of "topics open to public discussion. . . .Are there specific methods to address these impacts. . . .?".

Here are some reasons how the PUC environmental report very much differs from an EIS:

--PUC rules on pipelines allow the project proposer to so narrowly define the project that there is a large burden to overcome to define alternatives and even to analyze impacts. Pipeline rules favor existing corridors without a specific requirement to objectively analyze impacts of concentrating facilities in environmentally inappropriate areas. This would be impossible under an EIS.

--The PUC environmental report is finalized in-house. There is no opportunity to comment on a public review draft report. On draft EISs, the preparer is bound by law and rule to address reasonable comments supported by sound data. No such process exists for pipelines under PUC rules. With the case of Alberta Clipper, the ALJ report would have been found deeply flawed if it had been subject to the standards for responding to comments that are found in the EIS process.

--Finally, compare the PUC process for siting HVTL lines: it uses routine methods of comparing routes and alternatives that are answers to the question posed in the public notice.

VI. Proposed alternative routes and route enlargements

The PUC public notice solicits suggestions for alternative routes or route segments. In addition, Larry Hartman, the PUC person leading the Clearbrook public meeting, received a number of questions as to the burdensome format that appeared to be required for such proposals to be successful. He indicated alternatives would be considered that left out factors apparently required by the rules, and that a simple hand-drawn line on a map would be sufficient.

Therefore, the following recommendations for analyzing additional routes are provided:

VI. A. Widen Sandpiper route width wherever it is less than 1.25 miles in width. Enbridge has in many locations along its route narrowed the route nearly to the minimum required by the PUC rule. This greatly reduces the scope of analysis of impacts very early in the siting process. This very much reduces the flexibility of moving the centerline to reduce impacts as problems are discovered during site reviews. This problem was severe during the Alberta Clipper review. Therefore, the route width should be expanded to the maximum allowable along the entire

proposed route, as well as any new routes or route segments accepted for study. This is 1.25 miles in width. This will more appropriately meet the PUC requirements to adequately study environmental impacts. This is especially important at all crossings of rivers and other sensitive locations.

VI.B. Route segment following Enbridge's North Dakota Pipeline corridor to Clearbrook. Enbridge's web site indicates that the existing pipeline has the capacity to carry 475,000 bpd, yet Citation #2 says it is carrying 210,000 bpd at this time. If this is correct, there is excess capacity in the North Dakota line so as to allow it to carry the 225,000 bpd of the Sandpiper line. Therefore, there is a question as to whether another line is needed at this time for this route segment.

This route is clearly indicated on Enbridge's application.

VI.C. Enbridge Mainline Corridor, Clearbrook to Superior. This route should be studied as an alternative to Enbridge's preferred route. The study corridor should be widened to the maximum 1.25 miles. This route is clearly indicated on the Alberta Clipper PUC files, which are incorporated into this PUC record by reference.

VI.D. Any route alternatives studied for the Alberta Clipper project. There were a number of alternatives studied for the Alberta Clipper project. These routes are clearly identified on maps in the PUC record of that project. These include HVTL corridors and gas pipeline corridors. They should be re-studied for the Sandpiper project.

VI.E. LaSalle Creek alternative. An alternative which avoids the major problems of crossing LaSalle Creek and its valley at an angle needs to be studied. Adding two large diameter pipelines to this area—Sandpiper and the Line 3 replacement/upgrade—is extremely likely to have large off-right-of-way impacts to groundwater, Big LaSalle Lake, and LaSalle Creek. In addition, given the sub-surface conditions, it will be very hard to predict site-specific technical engineering plans for how to construct and maintain pipelines in this area. This could lead to massive problems and impact area growth during construction. This area could well become a case study of where not to build large pipelines.

A route avoiding this feature also crosses other areas with natural resource value, other private and public lands, and opens a new corridor. However, such an alternative for study must be accomplished because of escalating consequences of adding two more pipelines. I do not have an ability to submit a map today of my proposal, since I have to submit comments electronically in order to meet today's comment deadline. I can submit this by mail later. However, based on PUC statements made at the Clearbrook public meeting, this is sufficient as long as I describe the alternative in enough detail to identify it.

Here is a verbal description of the route: It is a 1.25 mile wide route deviating from the existing corridor in section 11 of Itasca Township in Clearwater County, then goes southwest to turn south along the east side of Clearwater County 2. It then turns SE to follow the north side of state highway 92, roughly paralleling it with the south edge of the route along this highway. It then turns east to rejoin the corridor in Section 32 of Lake Hattie township in Hubbard County.

On a final note, I believe it is within the PUCs ability to widen the "route" to more than 1.25 miles in this area.

VI.D. Enbridge Line #3 enlargement/replacement. PUC needs to formally include the potential routes for this project that is clearly now in the planning stage. In addition, PUC should begin entering into studies for this project to analyze the alternative of following the corridors for the Great Northern Transmission line, now under review, since this line comes from Canada, and is potentially a route to Superior.

VII. Significant impacts not otherwise indicated in these comments.

Here is a list of potential important impacts that need be addressed in the review of all route proposals, initially in a generic manner, and then as the focus is on site specific areas:

1. Analyze the advantages of topsoil separation in all areas where excavation into subsoil and parent material would otherwise result in mixing of parent material with top soil. It has been clearly demonstrated that creation of such disturbed areas leads to greater success for invasive species such as spotted knapweed and other noxious weeds. This also results in lowered productivity on not only farmland, but forest land, and reduced habitat value. In addition, it is becoming standard practice for responsible pipeline companies to accomplish this.

2. Requiring accurate depiction of any areas where excavation into parent material and subsoil occurs. Such excavation is routine in non-flat terrain in order to obtain the necessary 50-foot wide work pad for construction.

3. Detailed analysis of the product shipped in order to explore the environmental and human impacts of pipeline rupture.

4. Detailed analysis of the content of drilling muds to be used, and requirements for immediate notice to appropriate agencies when frac-outs occur during bores. Route permits should require agency review of any new additives considered during construction.

5. Careful analysis of the pros and cons of winter construction vs warm season construction. Such an analysis should be entirely independent of Enbridge desires to construct on their timetable, or for solely cost reduction reasons.

6. Careful analysis of the need for deep ripping of the work pad in areas of high clay soils. Operation of very heavy equipment along the work pad—which is essentially a road during construction—can create compaction layers in clayey soils that persist for as long as a projected 200 years.

7. Careful analysis and critique of proposed extra work space areas in sensitive locations such as stream crossings. Such areas sometimes are based solely on engineering requirements rather than given a careful review to reduce environmental impacts.

8. Careful review of the project's off-right- of- way affected area, and a PUC requirement that Enbridge submit all such areas to agencies for review.

9. An analysis of the damages caused by encroachment on the right of way from ATVs and other off-road highway vehicles. This has been observed to be intense in some areas, according to MDNR comment letters. The MDNR has no jurisdiction to respond to this use which can cause stream bank erosion, siltation, and so forth.

VIII. Cumulative Impacts.

As noted in the above comments, the PUC rules require that the Commission **shall** consider "cumulative potential impacts of related or anticipated future pipeline construction. . . ."

Enbridge recently announced it is planning to "replace" in the near future its Line 3 pipeline that is in now within the mainline corridor from Canada to Superior. The announcements also note that operation of the old Line 3 will continue until the new line—upgraded to 36 inches—is completed. Therefore the new line will not be in the same location as the old line. Enbridge has indicated in the announcements that it is considering both the Mainline Corridor to Superior and its preferred Sandpiper route. Therefore, the PUC needs to conduct the following analysis:

--Cumulative impacts of adding two large pipelines in these routes, including the existing corridors and the new Greenfield route east of Park Rapids, and on any alternatives to the Sandpiper project accepted for study.

--PUC needs to inform state agencies that are currently in the early stages of reviewing applications for Sandpiper (such as the MDNR and MPCA) that PUC is conducting a cumulative effects analysis on these two pipelines that may result in changes in locations. This should be done under the PUC rule cited above concerning responsibilities of the PUC to provide information **to** other stakeholders and the public.

List of attachments

1. Attachment 1. Estimates of oil/product flows in proposed and alternative corridors
2. Attachment 2. Enbridge schematic of its pipeline systems
3. Attachment 3. Web page from the US Department of transportation describing HCA areas
4. Attachment 4. Verbatim excerpts from an ORNL risk assessment appropriate for the Sandpiper project

CITATIONS

#1. Enbridge. 2013. "Enbridge Pipeline System Configuration." Quarter 1, 2013. Color chart showing entire Enbridge system in the United States and Canada, including data on individual lines, pipeline size, product type, and pipeline capacities (based on annual capacities). Available from one of the Enbridge web sites, and downloaded March 2014.

#2. Minnesota House of Representatives, House research. June 2013. Bob Eleff, Legislative Analyst. "Minnesota's Petroleum Infrastructure: Pipelines, Refineries, Terminals.

#3. Thompson/Reuters News Service. March 31, 2014. "Enbridge to expand Southern Lights Pipeline as demand rises." Reuters Business and Financial News.

#4. Reuters News Services. March 4, 2014. "Update 2—Enbridge to spend C$7 billion (Canadian) to replace pipeline to US." Reuters Business and Financial News. (Concerns Line #3) Also, at the same time, Enbridge web sites indicate this 34 inch line will be upgraded to 36 inches from 34, and the old line won't be decommissioned until the new line is in service.

#5. Forum News Services. March 5, 2014. John Myers. "Another Enbridge proposal would replace line from Canada to Wisconsin." Concerns Enbridge Line 3 upgrade as in #4, but this article quotes an Enbridge spokesperson that both the Sandpiper Route/Corridor and the Enbridge Mainline Corridor along US 2 are being looked at as possible locations.

#6. Federal Reserve Bank of Minneapolis. May 1, 2007. Kathy Cobb. "This nation's rapacious appetite for oil products and Canada's vast supply spur district pipeline projects." Newsletter. This article notes that MinnCan can be increased by 185,000 bpd to increase the Mn Pipeline Corridor to 640,000 bpd.

#7. Minnesota Public Utility Commission (PUC) public notice on Sandpiper, January 31, 2014.

#8. Oak Ridge National Laboratory 2012. "Studies for the Requirements of Automatic and Remotely Controlled Shutoff Valves on Hazardous Liquids and Natural Gas Pipelines with Respect to Public and Environmental Safety" Date Published: October 2012. Revised: December 2012. For U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration Pipeline Safety Program | East Building 2nd Floor 1200 New Jersey Avenue, S.E. Washington, DC 20590

#9. Online Oil and Gas Journal. January 17 2005. (Printed from site 3/29/2014.) "Method determines valve automation for remote pipelines."

Appendix 1, Attachment 1

ESTIESTIMATES OF EXISTING AND PROPOSED PIPELINE FLOWS RELATED TO PROPOSED SANDPIPER CORRIDORS AND TRANSLATED TO SELECTED RIVER FLOWS

Note: Pipeline capacities are given in barrels per day (bpd). Product flow rates are converted to cubic feet per second (cfs) in order to compare to typical river flows along the routes. Rates are calculated based on 42 gallons/barrel. A useful rule of thumb is that 100,000 bpd converts to 6.5 cfs. Product type is variable, and some information about types is given in Attachment 2.

A. Enbridge Pipelines from Minnesota border east to Clearbrook

Note: All lines are in one corridor except for North Dakota Pipeline which joins the "Mainline Corridor" at Clearbrook which then goes on to Superior roughly along US Highway #2.; Enbridge refers to the main corridor as "Enbridge Mainline Corridor.

A1. Existing Enbridge Pipelines

Note: All product flow is to the East-southeast except for the diluent line, which takes product from Illinois refineries back to Alberta for "thinning" heavy crude so it can be pumped in pipelines. Product types are listed by Enbridge in Attachment 2.

Pipeline name	Barrels per Day Amount	Flow rate cfs	Source	Pipe diameter	Citation
Line 1	236,500	15.4	Alberta	18/20 inches	#1
Line 2b	442,200	28.7	Alberta	24/26 inches	#1
Line 3	390,000	25.4	Alberta	34 inches	#1
Line 4	795,700	51.7	Alberta	36/48 inches	#1
Line 67 (Alberta Clipper)	450,000	29.2	Alberta	36 inches	#1
Line 65 (LSr)	186,000	12.1	North Dakota	20 inches	#1,#2
North Dakota Pipeline	210,000	13.6	North Dakota	?	#1, #2
Southern Lights Diluent	180,000	11.7	US refineries	20 inches	#2, #3
Totals	2,890,400 bpd	188 cfs			

A2. Expansion proposals by Enbridge, Minnesota border east to Clearbrook

Expansions:	bpd amount	cfs		Pipe Diameter	Citation
Line 3 increase**:**	370,000	24.0	(total 760,000)	34 inches to 36	#4
Line 67 increase:	350,000	22.8	(total 800,000)	Pumps added	#2
Southern Lights increase:	95,000	6.2	(total 275,000)	Pumps added	#3
New line					
Sandpiper	225,000	14.6		24 inches	#7
Subtotal (new + expand)	1,040,000	67.6			
Grand total, existing and expanded	3,930,400	255 cfs			

B. Enbridge Pipelines from Clearbrook east to Superior

Note: There is a major facility at Clearbrook whereby some product is routed south to the Twin Cities on 3 pipelines owned by the Minnesota Pipeline Company—a different company from Enbridge. One of these, the MinnCan line, was recently constructed. (There are evidently "loops" at a few locations, so that there may be 4 lines in place in the corridor at those locations.) According to Citation #2, currently this amount is 455,000 bpd. It is difficult to determine exact amounts in the two older lines, but it is not necessary for this level of analysis.

B.1. Existing Enbridge pipelines from Clearbrook to Superior

Note: For purposes of this analysis, it is sufficient to calculate a total of existing product flows from Clearbrook to Superior by subtracting the amount diverted south at Clearbrook from the total amount entering the Clearbrook terminal:

Total entering Clearbrook terminal: 2,890,400 bpd
Amount routed south: - 455,000 bpd
Total existing flows to Superior: 2,435,400 bpd or 158 cfs

B.2. Expansion proposals by Enbridge, Clearbrook to Superior

Note: An alternative route for the new proposed Sandpiper project is along this Enbridge mainline corridor. It is not listed here, but if it did follow this corridor, it would increase flows by 225,000 bpd, or 14.6 cfs. Also, the Line 3 replacement/expansion could follow the southern route, but is included here. If Line 3 would instead go south of Clearbrook, the amounts listed here should be decreased by 760,000 bpd or 49.4 cfs.

Pipeline name	bpd Amount	cfs		Pipe diameter	Citation
Line 3 increase:	370,000	24.0	(total 760,000)	34 inches to 36	#4
Line 67 increase:	350,000	22.8	(total 800,000)	Pumps added	#2
Southern Lights increase:	95,000	6.2	(total 275,000)	Pumps added	#3
Total increase:	815,000	53.0 cfs			
Grand total, existing +increases	3,250,400 bpd	211.2 cfs			

C. Pipelines routed south from Clearbrook

Note: New Enbridge proposals are to follow the existing Minnesota Pipeline Company corridor to near Park Rapids, and then create a new corridor east to Superior, Wisconsin,

C.1. Existing Pipelines to Twin Cities, Minnesota Pipeline Company (owned by Koch Industries)

Pipeline name	Amount	cfs	Source	Pipe diameter	Citation
MinnCan	165,000	10.7	Canada	24	#2
Two older pipelines	290,000	16.9	ND, Canada?	?	#2
Total, Minnesota Pipeline:	455,000	29.6			

C.2. Expanded capacity of Minnesota Pipeline Company

Total	640,000	41.6	Adding pumps?	#2

D. New Enbridge Pipelines potentially routed to existing corridor south from Clearbrook, then east from Park Rapids to Superior on new corridor

Note: Enbridge recently announced it is planning to "replace" and expand its older Line #3 in its mainline corridor across northern Minnesota to Superior, WI. It says it is also looking at instead going south from Clearbrook, then east from Park Rapids to follow the proposed Sandpiper route. Therefore, Line #3 is listed here in order to portray amounts of product potentially flowing in these corridors.

Pipeline name	bpd Amount	cfs	Source	Pipe diameter	Citation
Sandpiper	375,000	24.4	Alberta	30	#7
Line 3 expansion	760,000	49.4	Alberta	36	#4, #5
Total expansion:	1,135,000bpd	73.8cfs			

E. Total potential Enbridge and Minnesota Pipeline company from Clearbrook to Park Rapids

Pipeline Company	bpd Amount	cfs	Source	Citation
Minnesota Pipeline Co.	640,000	41.6	North Dakota, Canada	#2
Enbridge	1,135,000	73.8	Canada	#2, #5
Total in corridor:	1,775,000	115.4		

F. SUMMARY OF EXISTING AND PROPOSED OIL/PRODUCT FLOWS IN EXISTING PIPELINE CORRIDORS AS COMPARED TO SELECTED RIVER FLOWS

Company	Existing	cfs	Existing+Proposed	cfs
1 Enbridge N.D. Pipeline to Clearbrook	210,000	13.6	435,000	28.3
2 Enbridge mainline to Clearbrook	2,680,400	174.2	3,495,400	227cfs
3 Enbridge Clearbrook to Superior	2,435,400	158.0	3, 930,400	255 cfs
(Existing and proposed column includes Sandpiper and #3 expansion)				
4 Enbridge and MinnPipe Co. Clearbrook To south of Park Rapids	455,000	29.6	1,775,000	115.4
5 Enbridge, Park Rapids to Superior	No corridor	000	1,135,000	73.8

River name and location	Long-term median river flows (cfs) on this date from USGS Gauges, April 2, 2014	Approximate % of maximum oil flow to river flow
Snake river above Warren	124	183 percent
Clearwater river at Plummer	172	132percent
Mississippi river at Bemidji	334	76 percent
Straight River south of Park Rapids	69	167 percent
Mississippi River at Grand Rapids	716	36 percent
Mississippi River at Aitkin	2,859	2.6 percent*
Prairie River at Taconite	125	204 percent

St. Louis River at Scanlon		1,850	14 percent

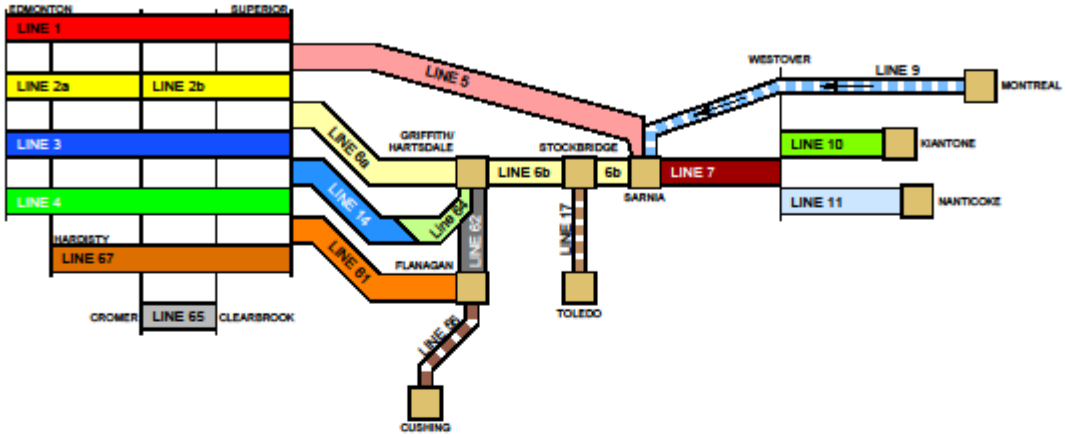
*New Enbridge corridor from Park Rapids to Superior crosses in this vicinity; all else are Enbridge mainline

1 **APPENDIX 1, ATTACHMENT 2**

Pipeline System Configuration

Quarter 1, 2013

ENBRIDGE



Line 1
37,600 m³/d (236.5 kbpd)
18"/20" - 1098 miles
NGL
Refined Products
Light Synthetics

Line 2
Line 2a
70,300 m³/d (442.2 kbpd)
24" - 596 miles
Line 2b
70,300 m³/d (442.2 kbpd)
24"/26" - 502 miles
Condensates
Light Synthetics
Sweet
Light & High Sour

Line 3
62,000 m³/d (390.0 kbpd)
34" - 1098 miles
Condensates (Edmonton to Hardisty)
Light Synthetics
Sweet
Light & High Sour

Line 4
126,500 m³/d (795.7 kbpd)
36"/48" - 1098 miles
Heavy
Medium (Ex-Clearbrook)
Light Sour (Ex-Clearbrook)

Line 5
78,100 m³/d (491.2 kbpd)
30" - 645 miles
NGL
Light Synthetics
Sweet
Light & High Sour

Line 6
Line 6a
106,000 m³/d (666.7 kbpd)
34" - 467 miles
Line 6b
45,000 m³/d (283.0 kbpd)
30" - 293 miles
Light Synthetics (Superior to Lookport)
Sweet (Superior to Lookport)
Light & High Sour
Medium
Heavy

Line 7
23,900 m³/d (150.3 kbpd)
20" - 120 miles
Light Synthetics
Sweet
Light & High Sour
Medium
Heavy

Line 65
29,500 m³/d (185.6 kbpd)
20" - 313 miles
Light Sour
Medium

Line 10
11,800 m³/d (74.2 kbpd)
12"/20" - 91 miles
Light Synthetics
Sweet
Light & High Sour
Medium
Heavy

Line 11
18,600 m³/d (117.0 kbpd)
16"/20" - 47 miles
Condensates
Light Synthetics
Sweet
Light & High Sour
Medium
Heavy

Line 62
20,700 m³/d (130.2 kbpd)
22" - 75 miles
Heavy

L 14 / L 64
50,500 m³/d (317.6 kbpd)
24" - 467 miles
Light Synthetics
Sweet
Light & High Sour
Medium

Line 61
63,600 m³/d (400.0 kbpd)
42" - 454 miles
Light Synthetics
Sweet
Light & High Sour
Medium
Heavy

Line 67
71,500 m³/d (449.7 kbpd)
36" - 999 miles
Heavy

Not Part of the Enbridge Mainline System

Line 9
38,200 m³/d (240.3 kbpd)
30" - 524 miles
Condensates
Sweet
Medium
Light & High Sour

Line 17
16,000 m³/d (100.6 kbpd)
16" - 88 miles
Heavy

Line 55
30,700 m³/d (193.3 kbpd)
22"/24" - 575 miles
Light Synthetics
Sweet
Light & High Sour
Medium
Heavy

NOTES:

Capacities provided are Annual Capacities and do not include current restrictions.

Updated: January 2013
File: 2013_Q1 System Config.dwg

Revised by: YZ
Drawn by: DRD

2
3
4

APPENDIX 1, ATTACHMENT 3

Fact Sheet: High Consequence Areas (HCA)

Quick Facts:

- *Consequences of inadvertent releases from pipelines can vary greatly, depending on where the release occurs, and the commodity involved in the release.*
- *Releases from pipelines can adversely affect human health and safety, cause environmental degradation, and damage personal or commercial property.*
- *Pipeline safety regulations use the concept of "High Consequence Areas" (HCAs), to identify specific locales and areas where a release could have the most significant adverse consequences. Once identified, operators are required to devote additional focus, efforts, and analysis in HCAs to ensure the integrity of pipelines.*

What criteria define HCA's for pipelines?

Because potential consequences of natural gas and hazardous liquid pipeline releases differ, criteria for HCAs also differ. HCAs for natural gas transmission pipelines focus solely on *populated areas*. (Environmental and ecological consequences are usually minimal for releases involving natural gas.) Identification of HCAs for hazardous liquid pipelines focus on *populated areas, drinking water sources*, and *unusually sensitive ecological resources*.

- *Populated areas* include both high population areas (called "urbanized areas" by the U.S. Census Bureau) and other populated areas (areas referred to by the Census Bureau as a "designated place").
- *Drinking water sources* include those supplied by surface water or wells and where a secondary source of water supply is not available. The land area in which spilled hazardous liquid could affect the water supply is also treated as an HCA.
- *Unusually sensitive ecological areas* include locations where critically imperiled species can be found, areas where multiple examples of federally listed threatened and endangered species are found, and areas where migratory waterbirds concentrate.

HCAs for natural gas transmission pipelines:

- An equation has been developed based on research and experience that estimates the distance from a potential explosion at which death, injury or significant property damage could occur. This distance is known as the "potential impact radius" (or PIR), and is used to depict potential impact circles.
- Operators must calculate the potential impact radius for all points along their pipelines and evaluate corresponding impact circles to identify what population is contained within each circle.
- Potential impact circles that contain 20 or more structures intended for human occupancy;, buildings housing populations of limited mobility; buildings that would be hard to evacuate (e.g., nursing homes, schools); or buildings and outside areas occupied by more than 20 persons on a specified minimum number of days each year, are defined as HCA's.

How do operators of pipelines know where HCA's are located?

- High population areas and other populated areas are identified using maps and data from the U.S. Census bureau.
- Critical drinking water sources and unusually sensitive ecological areas are identified using information from National Heritage Programs and Conservation Data Centers in each state, in conjunction with The Nature Conservancy.

- Because of the complexity of HCAs for Hazardous Liquid Pipelines, the Office of Pipeline Safety identifies and maps HCAs for Hazardous Liquids on its National Pipeline Mapping System (NPMS). These maps are revised periodically by OPS based on new and updated information.
- Operators of natural gas transmission pipelines must use a specified equation to calculate the radius of "potential impact circles" along their pipeline and compare the structures in those circles to the HCA criteria in the rule.

How do operators determine what pipeline segments require extra integrity protection due to the presence of HCAs?

- Pipeline operators must determine which segments of their pipeline could affect HCAs in the event of a release. This determination must be made assuming that a release can occur at any point, even though the likelihood of a release at any given point is very small.
- Hazardous liquid pipelines that pass through an HCA, or that pass near enough that a release could reach the area by flow over land or within a river, stream, lake, or other means, are assumed to have the potential to affect that area.
- Gas transmission pipelines that pass within any of the HCA potential impact circles are assumed to have the potential to affect that area. (Or, alternatively, operators may choose to treat all of their pipeline segments in Class 3 and 4 areas as HCAs.)

Date of Revision: 12012011

APPENDIX 1, ATTACHMENT 4

VERBATIM EXCERPTS FROM THE FOLLOWING PIPELINE RISK ASSESSMENT OF SHUTOFF VALVES, INCLUDING ESTIMATES OF AMOUNTS OF RELEASES OF OIL AND OTHER PRODUCT FROM RUPTURES

Oak Ridge National Laboratory 2012. "Studies for the Requirements of Automatic and Remotely Controlled Shutoff Valves on Hazardous Liquids and Natural Gas Pipelines with Respect to Public and Environmental Safety" Date Published: October 2012. Revised: December 2012. For U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration Pipeline Safety Program | East Building 2nd Floor 1200 New Jersey Avenue, S.E. Washington, DC 20590

ABSTRACT

Author's note: This 340 page study primarily concerns worst-case pipeline ruptures in populated areas, and was stimulated by a large California rupture of a gas pipeline in a urban area in California that killed 8 people. However, it also considers oil pipelines that do not catch fire, and those in High Consequence Areas (HCAs) that are also in or near ecologically significant areas. Therefore, it is highly relevant to the necessary route evaluation and environmental impact evaluation of the Sandpiper proposal. The underlined portions indicate relevancy to Sandpiper, and in each case are the author's emphasis when they appear in the text. Page numbers at the bottom of the pages are excerpt page numbers rather than as in the original text. Some of the text concerns propane lines, so it is best to access the whole report in order to follow its reasoning. It is included here because it illustrates methods of analyzing ruptures. ". . . . . ." indicates breaks in quoted text.

Two actual rather than theoretical oil spills are described on page in this study in order to compare actual vs modelled spill costs. (See page 11 below.) The 30-inch Enbridge Pipeline spill of 20,000 barrels of crude oil into Talmadge Creek and the Kalamazoo River in Michigan. It occurred in 2010. Actual clean-up costs to date are $767,000,000. A 12-inch ExxonMobil pipeline ruptured in the bed of the Yellowstone River in Montana in 2011. About 1,509 barrels of oil were released. Clean-up costs to-date are $135,000,000.

This study assesses the effectiveness of block valve closure swiftness in mitigating the consequences of natural gas and hazardous liquid pipeline releases on public and environmental safety. It also evaluates the technical, operational, and economic feasibility and potential cost benefits of installing automatic shutoff valves (ASVs) and remote control valves (RCVs) in newly constructed and fully replaced transmission lines. Risk analyses of hypothetical pipeline release scenarios are used as the basis for assessing: . . . . and <u>(3) socioeconomic and environmental damage in HCAs caused by hazardous liquid pipeline releases of crude oil</u>. . . . . .However, these results may not apply to all newly constructed and fully replaced pipelines because <u>site-specific parameters that influence risk analyses and feasibility evaluations often vary significantly from one pipeline segment to another and may not be consistent with those considered in this study. Consequently, the technical, operational, and economic feasibility and potential cost benefits . . . . . .need to be evaluated on a case-by-case basis</u>. In theory, installing

ASVs and RCVs in pipelines can be an effective strategy for mitigating potential consequences of unintended releases because decreasing the total volume of the release reduces overall impacts on the public and to the environment. However, block valve closure has no effect on preventing pipeline failure or stopping the product that remains inside the isolated pipeline segments from escaping into the environment. The benefits in terms of cost avoidance attributed to block valve closure swiftness increase as the time required to isolate the damaged transmission pipeline segment decreases. Block valve closure swiftness is most effective in mitigating damage resulting from a pipeline release. . . . .. Similarly, the avoided cost of socioeconomic and environmental damage for hazardous liquid pipeline releases without ignition increase as time required to isolate the damaged pipeline segment decreases.. . . .

The scope of the study is further limited by considering only worst case pipeline release scenarios in HCAs involving guillotine-type breaks rather than other more common breaks, such as punctures and through-wall cracks. Although ignition of the released product following a rupture is not ensured, this study only models release scenarios that result in immediate ignition of the released product at the break location. The study also assesses potential socioeconomic and environmental effects of unintended crude oil releases without ignition from hazardous liquid pipelines in HCAs.

EXECUTIVE SUMMARY

The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) is the Federal safety authority responsible for ensuring safety in the design, construction, operation and maintenance, and spill response planning for the 2.3 million (M) miles of natural gas and hazardous liquid transportation pipelines in the United States. Its mission is to protect people and the environment from the risks inherent in transportation of hazardous materials by pipeline and other modes of transportation. . . . Section 4 of the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 calls for the Secretary of the U.S. Department of Transportation (DOT) to require by regulation the use of automatic or remotely controlled shutoff valves, or equivalent technology, where it is economically, technically, and operationally feasible on hazardous liquid and natural gas transmission pipeline facilities constructed or entirely replaced after the final rule was issued.. . . .The Act also requires a study to discuss the ability of transmission pipeline facility operators to respond to a hazardous liquid or natural gas release from a pipeline segment located in a high consequence area (HCA). . . . . .

(This) study assesses the effectiveness of block valve closure swiftness in mitigating the consequences of natural gas and hazardous liquid pipeline releases on public and environmental safety. . . . . .It also evaluates the technical, operational, and economic feasibility and potential cost benefits of installing ASVs and RCVs in newly constructed and fully replaced pipelines. The results of this study apply to natural gas and hazardous liquid transmission lines. . . . .Potential effects of unintended releases from natural gas and hazardous liquid pipelines on public and environmental safety are categorized as personal injuries and fatalities, property damage, and environmental impacts.

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Hazardous liquid pipeline operators are required to install block valves at prescribed locations to facilitate isolation of pump stations, breakout storage tanks, and lateral takeoffs and other points along the pipeline near designated bodies of water and populated areas to minimize damage and

pollution from an accidental hazardous liquid discharge. In addition, operators are required to consider installing emergency flow restricting devices such as check valves and RCVs on pipeline segments to protect a HCA in the event of a hazardous liquid pipeline release. In making this determination, an operator must, at least, consider the swiftness of leak detection and pipeline shut down capabilities and benefits expected by reducing the spill size.

E.1 CONSEQUENCE MODELS

Risk analyses of hypothetical pipeline release scenarios are used as the basis for assessing: . . . . . .(3) socioeconomic and environmental damage in HCAs caused by hazardous liquid pipeline releases of crude oil.

E.4 ASSESSMENT METHODOLOGY AND RESULTS FOR HAZARDOUS LIQUID PIPELINE RELEASES WITHOUT IGNITION

Potential consequences on the human and natural environments resulting from a hazardous liquid release without ignition generally involve socioeconomic and environmental impacts. These impacts are influenced by the total quantity of hazardous liquid released and the habitats, resources, and land uses that are affected by the release. The methodology used in this study to quantify socioeconomic and environmental impacts resulting from a hazardous liquid release involves computing the quantity

of hazardous liquid released as a function of block valve closure time and then using this quantity to establish the total damage cost based on the EPA's BOSCEM. The total damage cost is determined as follows:

- Add the unit response cost, the unit socioeconomic damage cost, and the unit environmental damage cost;
- Multiply the sum of these costs by the number of barrels spilled; and
- Apply a damage cost adjustment factor which aligns the total damage cost with the actual cleanup costs reported for recent crude oil spills in environmentally sensitive areas. The damage cost for crude oil released in the Enbridge Line 6B pipeline rupture in Marshall, Michigan in 2010 was approximately $38,000 per barrel.

The BOSCEM accounts for effects of spill size on the total damage cost by reducing the unit cost of damage as the number of barrels spilled increases.

The swiftness of block valve closure has a significant effect on mitigating potential socioeconomic and environmental damage to the human and natural environments resulting from hazardous liquid pipeline releases because damage costs increase as the spill size increases. The benefit in terms of cost avoidance for damage to the human and natural environments attributed to block valve closure swiftness increases as the duration of the block valve shutdown phase decreases.

1.3.2 Hazardous Liquid Pipeline Release Events

After a hazardous liquid pipeline ruptures, liquid begins flowing from the break and continues until draining is complete. The amount of material released following the break is influenced by a variety of factors. These factors include the type of liquid, the operating pressure of the pipeline, the size and position of the hole through which the liquid is released, the rate at which the liquid is being pumped through the pipeline, the response of the operator in terms of shutting off pumps and closing valves, the pipeline route and elevation profile, and the location of the break relative to the pumps and block valves. Block valves are installed in hazardous liquid pipelines to facilitate maintenance, operations, or construction and to limit the amount of liquid spilled following a pipeline rupture. For worst case, guillotine-type breaks, the effective hole size is equal to the line pipe diameter.

The behavior of the released liquid depends on its physical properties and the terrain in the vicinity of the break. For example, the liquid could flash on release of pressure to form a vapor cloud containing a fine mist of residual liquid droplets, accumulate in a pool on the ground surface near the pipeline break, create a stream that flows away from the release point, or soak into the surrounding soil (Acton, 2001).

If the released liquid ignites following the break, it could result in a pool fire, a flash fire, or, under certain conditions, a vapor cloud explosion. Pool fires can spread out in all directions or flow in a particular path depending on the terrain. Figure 1.3 shows fire damage along a creek caused by a hazardous liquid pipeline release in Bellingham, Washington (NTSB, 2002). If ignition is delayed, the resulting evolution of vapor from the release could influence the magnitude and extent of a subsequent flash fire or explosion.

Fig. 1.3. Fire damage resulting from hazardous liquid pipeline release in Bellingham, Washington (NTSB, 2002).

Impacts resulting from time-dependent radiant thermal intensities at various separation distances from the break are based on the following hazardous liquid pipeline release scenario. The release occurs following a guillotine-type break where the escaping liquid accumulates in a pool on an impermeable level ground surface and ignites immediately upon release. Pool size is affected by the type of liquid released, the line pipe diameter, the pipeline operating pressure, the time required to detect the leak and initiate corrective actions to mitigate the consequences of the release, the spacing of block valves, the time required to close block valves and isolate the break, and the terrain features. Any potential environmental impacts to air and water quality caused by the released liquids and their products of combustions are beyond the scope of this study.

As discussed in Section 1.3.1, thermal radiation hazard zones with increasing impact severity are described by concentric circles centered on the pipeline rupture. The thermal radiation intensities at the perimeters of these concentric circles increase as the radii decrease. Effects of progressively higher heat fluxes on buildings and humans are described in Table 1.1. Because thermal radiation effects on buildings and humans are a function of radiant heat flux and exposure duration, quantifying the time dependent variations in radiant heat fluxes for specific radii is key to assessing the benefits of installing RCVs and ASVs in hazardous liquid pipelines.

Given the wide range of actual pipeline sizes and operating pressures, leak detection periods, and block valve spacing and closure times, ORNL developed methodologies for quantifying the impacts of these parameters on areas affected by combustion of the escaping liquid hydrocarbon. The methodologies, which are described in Section 3.2, also characterize time-dependent radiant thermal intensities at various separation distances from the break.

Without ignition, the escaping liquid could adversely affect waterway navigation, surface and ground water quality, and other aspects of the human and natural environments. In addition, the cost to remediate the affected areas could be substantial. Consequence mitigation for a hazardous liquid pipeline release without ignition requires rapid detection, pump shutdown, and block valve closure. However, even if these actions are taken quickly, some amount of liquid in the pipeline will drain out of the broken pipeline segments. Methodologies for quantifying spill volumes for hazardous liquid pipelines releases and for estimating socioeconomic and environmental damage caused by the spill are described in Section 3.3.

1.3.2.1 Phases of a Hazardous Liquid Pipeline Release

A pipeline break can range in size and shape from a short, through-wall crack to a guillotine fracture that completely separates the line pipe along a circumferential path. Although the volume of the discharge depends on many factors, the event is subdivided into four sequential phases – Phase 1 Detection, Phase 2 Continued Pumping, Phase 3 Block Valve Closure, and Phase 4 Pipeline Drain Down (Borener, 1994 and California State Fire Marshal, 1993). The total discharge volume equals the sum of the volumes released during each phase. Events associated with each phase are described below.

Phase – 1 Detection: The detection phase begins immediately after the pipeline ruptures, t0, and continues until the leak is detected by any means and the Operator initiates corrective actions to mitigate the consequences of the release, td. The volume of liquid discharged during the detection phase, Vd, depends on the duration of this phase and is influenced by factors such as the size, shape, and location of the rupture; the pumping rate; the pipeline pressure; and the effectiveness of the leak detection system.

The volume of liquid discharged during the detection phase is determined using the following equation. . . . . .

Phase 2 – Continued Pumping: The continued pumping phase starts after corrective actions are initiated to mitigate the consequences of the release, td, and ends when the pumps stop operating, tp.

During this time, additional hazardous liquid spills from the break. The duration of this phase can vary from a few minutes for systems with remotely operated pumps to hours for manually operated equipment located in remote areas. The volume of liquid discharged during the continued pumping phase, Vp, depends on the duration of this phase and is influenced by factors such as the type of equipment controls (automatically, remotely, or manually operated); personnel travel time to shutdown manually operated equipment; and the flow rates of the pumps. . . . . .

Phase 3 – Block Valve Closure: The block valve closure phase starts when the pumps stop operating, tp, and ends when the upstream and downstream block valves close, ts. During this time, an additional amount of liquid in the pipeline spills from the break. The volume of liquid discharged during the block valve closure phase, Vs, depends on the duration of this phase and is influenced by factors such as the speed at which block valves located upstream and downstream from the break close. The duration of this phase can vary from a few minutes for systems with automatic or remotely controlled valves to hours for systems with manually operated valves located in remote areas. . . . . .

Phase 4 – Pipeline Drain Down: The pipeline drain down phase starts when the upstream and downstream block valves close isolating the portion of the pipeline that includes the break, ts. This phase ends when the remaining contents of the isolated portion of the damaged pipeline segment drain from the break, tf. The volume of liquid discharged during the drain down phase, Vf, is affected by the pipeline elevation profile including siphon action and the location of the break. A break that occurs at the highest elevation in the isolated portion of the pipeline results in no drain down volume, whereas a break that occurs at the lowest elevation could result in significant or complete drain down of the isolated portion of the pipeline.

The rate at which liquid drains from a break in the isolated portion of the damaged pipeline segment depends primarily on the size of the break and the pipeline elevation profile. It is also affected by the flow rate of air that must enter the break to replace the liquid and allow the draining to continue. In hilly or mountainous terrain, determining the length of pipeline, L, available to drain from a break must consider site-specific design and construction details. The volume of liquid discharged from the contributory length of pipeline, L, during the drain down phase, Vf, and the transient discharge rate, Qf, cannot be accurately determined without knowing the actual pipeline elevation profile as illustrated in Fig. 1.4. . . . . .

1.3.2.2 Block Valve Effects on a Hazardous Liquid Pipeline Release

The effectiveness of block valve closure swiftness on limiting the spill volume of a hazardous liquid pipeline release is influenced by the location of the block valves relative to the location of the break, the pipeline elevation profile between adjacent block valves, and the time required to close the block valves after the break is detected and the pumps are shut down.

Block valves do not reduce the volume of liquid spilled during the detection and continued pumping phases because they are open. However, the total spill volume can be reduced by rapidly detecting the leak and taking immediate corrective actions including shutting down the

pumps and closing the block valves to mitigate the consequences of the release. The effectiveness of block valve closure in mitigating the consequences of a hazardous liquid pipeline release decreases as the time required to close the block valve increases.. . . . . .

1.3.5 Socioeconomic and Environmental Effects of a Hazardous Pipeline Release

Potential consequences and effects on the human and natural environments resulting from a hazardous liquid pipeline release without ignition generally involve socioeconomic and environmental impacts. These impacts are influenced by the total quantity of hazardous liquid released and the habitats, resources, and land uses that are affected by the release. The methodology used to quantifying socioeconomic and environmental impacts resulting from a hazardous liquid release involves computing the quantity of hazardous liquid released and then using this quantity to establish the total damage cost. The total damage cost is determined by adding the response cost, the socioeconomic damage cost, and the environmental damage cost as described in Section 3.3.3. . . . . .

3.2 HAZARDOUS LIQUID PIPELINES WITH IGNITION

Following a guillotine-type break in a hazardous liquid pipeline and ignition of the released hydrocarbon, a pool fire begins to form and continues to increase in diameter as liquid flows from the break. Eventually, the pool reaches an equilibrium diameter when the mass flow rate from the break equals the fuel mass burning rate. The fire will continue to burn until the liquid that remains in the isolated pipeline segments stops flowing from the pipeline.

A pipeline break can range in size and shape from a short, through-wall crack to a guillotine fracture that completely separates the line pipe along a circumferential path. Guillotine-type breaks are less common than other pipeline breaks such as fish-mouth type openings, but they can occur as a result of different causes including landslides, earthquakes, soil subsidence, soil erosion (e.g. scour in a river) and third-party damage. The guillotine-type break is the largest possible break and is therefore considered in this study as the worst case scenario. Although the volume of the discharge depends on many factors, to enable analysis, the event is divided into four sequential phases with the total discharge volume equal to the sum of the volumes released during each phase. The four phases (detection, continued pumping, block valve closure and pipeline drain down) are explained in Section 1.3.2.1.

The thermal radiation hazards from a hydrocarbon release and resulting pool fire depend on a variety of factors including the composition of the hydrocarbon, the size and shape of the fire, the duration of the fire, its proximity to the objects at risk, and the thermal characteristics of the object exposed to the fire.

3.3 HAZARDOUS LIQUID PIPELINES WITHOUT IGNITION

The socioeconomic and environmental effects of an oil spill are strongly influenced by the circumstances surrounding the spill including the type of product spilled, the location and timing of the spill, sensitive areas affected or threatened, liability limits in place, local and national laws, and cleanup strategy. The most important factors determining a per-unit cost are location and oil type, and possibly total spill amount.

The amount of oil spilled can have a profound effect on the cleanup costs. Obviously, the more oil spilled, the more oil there is to remove or disperse, and the more expensive the cleanup operation. However, cleanup costs on a per-unit basis decrease significantly with increasing amounts of oil spilled. Smaller spills are often more expensive on a per-unit basis than larger

spills because of the costs associated with setting up the cleanup response, bringing in the equipment and labor, as well as bringing in the experts to evaluate the situation (Etkin, 1999).

The following methodology was used to determine: (1) the time-dependent discharge from a hazardous liquid transmission pipeline resulting from a guillotine-type break, and (2) the quantity of hazardous liquid released during the detection, continued pumping, block valve closure, and drain down phases needed to estimate cleanup costs. The total volume of a hazardous liquid pipeline release is primarily influenced by the flow rate at the time of the break; the combined durations of the detection, continued pumping, block valve closure phases; and the size and shape of the break. For worst case, guillotine-type breaks, where the effective hole size is equal to the line pipe diameter, the governing parameters are the line pipe diameter and the pipeline length between plateaus and peaks in the vicinity of the break.

Appendix A: Spill Volume Released Due to Valve Closure Times in Liquid Propane Pipelines, contains a family of curves for various hazardous liquid pipeline release scenarios that quantify the volume of liquid released following a guillotine-type break.

3.3.1 Analysis Scope, Parameters, and Assumptions

The methodology is based on fundamental fluid mechanics principles for computing the time-dependent response of hazardous liquid pipelines following a guillotine-type break. It is also suitable for determining the effects that detection, continued pumping, block valve closure duration have on a worst case discharge release determined in accordance with federal pipeline safety regulations in 49 CFR 194 for estimating worst case discharges from hazardous liquid pipelines (DOT, 2011e).

The configuration of the hypothetical hazardous liquid pipeline used to evaluate the effectiveness of RCVs and ASVs in mitigating the consequences of a release has the following design features and operating characteristics:

- The pump stations are located at 100 mile intervals along the pipeline.
- Each pressure pump station has a remote control device that can be activated by the pipeline operator to shut down the compressors after a rupture occurs.
- The rupture is a guillotine-type break that initiates the release event.
- The break is located at a low point in the pipeline elevation profile.
- The following times are study variables.
- The time when the operator detects the leak.
- The time when the operator stops the pumps.
- The time when the upstream and downstream block valves are closed and the line section with the break is isolated.
- The total volume of the hazardous liquid release equals the volume of liquid released during the detection, continued pumping, block valve closure, and drain down phases.
- The time-dependent flow rate is a study variable.

Study variables used to characterize hazardous liquid pipeline releases are listed in Table 3.24.

3.3.2 Analytical Approach and Computational Models

After a hazardous liquid pipeline ruptures without ignition, liquid begins flowing from the break and continues until draining is complete. A pipeline break can range in size and shape from a short, through-wall crack to a guillotine fracture that completely separates the line pipe

along a circumferential path. Although the volume of the discharge depends on many factors, the event is subdivided into the four sequential phases with the total discharge volume equal to the sum of the volumes released during each phase. The phases of a hazardous liquid pipeline release are outlined in Section 1.3.2.1. . . . .

The flow rate through the break remains constant through both the detection and continued pumping phases. In the block valve closure phase, the maximum flow rate through the break is based on the elevation difference of liquid in the pipeline. During the pipeline drain down phase, the maximum flow rate through the break is based on the difference between the operating pressure of the pipeline and atmospheric pressure. Requirements in 49 CFR 194.105(b)(1) state the worst case discharge is the largest volume of fluid released based on the pipeline's maximum release time, plus the maximum shutdown response time, multiplied by the maximum flow rate, which is based on the maximum daily capacity of the pipeline, plus the largest line drainage volume after shutdown of the line sections. In this methodology, the maximum flow rate can be estimated by multiplying the fluid speed at the pump by the cross sectional area of the line pipe. Although operators can use this rule to determine a worst case discharge, the actual flow rate during the block valve closure phase may be greater (less conservative) due to factors such as fluid density, pressure changes, pump performance characteristics, and the elevation profile of the pipeline which are not reflected in the methodology. These factors are important in a risk analysis because their effects influence time-dependent damage resulting from a release.

The influence of fluid density, pressure changes, and the elevation profile of the pipeline is taken into consideration in this study by using Bernoulli's equation to calculate the flow rate during the block valve closure and drain down phases. However, there are recognized limitations in using Bernoulli's equation to determine drain down time because it does not model the effects of air flow through the pipeline break which occurs as the fluid escapes following block valve closure. Although Bernoulli's equation does not produce an exact solution to this fluid dynamics problem, comparison of the results provides a consistent approach for evaluating the effectiveness of block valve closure swiftness on mitigating release consequences.

3.3.3 Socioeconomic and Environmental Effects

The methodology for quantifying potential environmental effects resulting from a hazardous liquid release involves computing the quantity of hazardous liquid released and then using this quantity to establish the total damage cost. The total damage cost, Cd, is determined by adding the response cost, Cr, the socioeconomic damage cost, Cs, and the environmental damage cost, Ce. This methodology applies to crude oil and light fuel (gasoline) releases that affect the following areas.

- Commercially navigable waterways which means a waterway where a substantial likelihood of commercial navigation exists.
- High population areas and another populated areas which mean an urbanized area as defined and delineated by the Census Bureau that contains 50,000 or more people and has a population density of at least 1,000 people per square mile and a place as defined and delineated by the Census Bureau that contains a concentrated population, such as an incorporated or unincorporated city, town, village, or other designated residential or commercial area, respectively.

 Unusually Sensitive Areas (USAs) which is defined in 49 CFR 195.6 to mean a drinking water or ecological resource area that is unusually sensitive to environmental damage from a hazardous liquid pipeline release.

The response cost, Cr, is determined by multiplying the applicable unit response cost shown in Table 3.25 by the applicable medium modifier shown in Table 3.26. . . . . .

The response cost, *Cr*, is determined by multiplying the applicable unit response cost shown in Table 3.25 by the applicable medium modifier shown in Table 3.26.

Table 3.25. Unit response costs for crude oil and light fuel releases Release Quantity, barrels	**Crude Oil, $ per barrel**	**Light Fuels, $ per barrel**
<12	9,240	4,200
12-24	9,156	4,116
24-240	9,030	4,074
240-2,400	8,190	3,654
2,400-240,000	5,166	3,108
> 240,000	3,864	1,302

Table 3.26. Modifier for location medium categories for crude oil and light fuel releases Medium Category	**Medium Modifier**
Open Water/Shore	1.0
Soil/Sand	0.6
Pavement/Rock	0.5
Wetland	1.6
Mudflat	1.4
Grassland	0.7
Forest	0.8
Taiga (boreal forest)	0.9
Tundra	1.3

The socioeconomic damage cost, *Cs*, is determined by multiplying the applicable unit socioeconomic cost shown in Table 3.27 by applicable the socioeconomic cost modifier shown in Table 3.28.

Table 3.27. Unit socioeconomic and environmental costs for crude oil and light fuel releases Release Quantity, barrels	**Crude Oil, $ per barrel**		**Light Fuels, $ per barrel**	
Socioeconomic	**Environmental**	**Socioeconomic**	**Environmental**	

<12	2,100	3,780	3,360	3,570
12-24	8,400	3,654	13,860	3,360
24-240	12,600	3,360	21,000	2,940
240-2,400	5,880	3,066	8,400	2,730
2,400-240,000	2,940	1,470	4,200	1,260
> 240,000	2,520	1,260	3,780	1,050

1
2

Table 3.28. Socioeconomic and cultural value ranking for crude oil and light fuel releases Value Rank	**Release Impact Site Description**	**Examples**	**Cost Modifier Value**
Extreme	Predominated by areas with high socioeconomic value that may potentially experience a large degree of long-term impact if oiled.	Subsistence/commercial fishing, aquaculture areas	2.0
Very High	Predominated by areas with high socioeconomic value that may potentially experience some long-term impact if oiled.	National park/reserves for ecotourism/nature viewing; historic areas	1.7
High	Predominated by areas with medium socioeconomic value that may potentially experience some long-term impact if oiled.	Recreational areas, sport fishing, farm/ranchland	1.0
Moderate	Predominated by areas with medium socioeconomic value that may potentially experience short-term impact if oiling occurs.	Residential areas; urban/suburban parks; roadsides	0.7
Minimal	Predominated by areas with a small amount of	Light industrial areas; commercial zones; urban areas	0.3

	socioeconomic value that may potentially experience short-term impact if oiled.		
None	Predominated by areas already moderately to highly polluted or contaminated or of little socioeconomic or cultural import that would experience little short- or long-term impact if oiled.	Heavy industrial areas; designated dump sites	0.1

Note: Long-term impacts are those impacts that are expected to last months to years after the spill or be relatively irreversible. Short-term impacts are those impacts that are expected to last days to weeks after the spill occurs and are generally considered to be reasonably reversible.

Table 3.29. Freshwater vulnerability categories for crude oil and light fuel releases Freshwater Vulnerability Category	**Freshwater Vulnerability Modifier**
Wildlife Use	1.7
Drinking	1.6
Recreation	1.0
Industrial	0.4
Tributaries to Drinking/Recreation	1.2
Non-Specific	0.9

Table 3.30. Habitat and wildlife sensitivity categories for crude oil and light fuel releases Habitat and Wildlife Sensitivity Category	**Habitat and Wildlife Sensitivity Modifier**
Urban/Industrial	0.4
Roadside/Suburb	0.7
River/Stream	1.5
Wetland	4.0
Agricultural	2.2
Dry Grassland	0.5
Lake/Pond	3.8
Estuary	1.2
Forest	2.9

Taiga	3.0
Tundra	2.5
Other Sensitive	3.2

This methodology is consistent with the U.S. Environmental Protection Agency (EPA) Basic Oil Spill Cost Estimation Model (BOSCEM) that was developed to provide the US EPA Oil Program with a methodology for estimating oil spill costs, including response costs and environmental and socioeconomic damages, for actual and hypothetical spills (Etkin, 2004).

Total Damage Cost Validation

The following case studies compare the actual damage costs for two hazardous liquid pipeline releases to the corresponding total damage costs determined using BOSCEM.

Case Study 1 – Enbridge 2010

The Enbridge Line 6B pipeline ruptured in Marshall, Michigan on July 25, 2010, and released approximately 20,000 barrels of crude oil. This release from the 30-in. nominal diameter pipeline caused environmental impacts along Talmadge Creek and the Kalamazoo River (Nicholson, 2012). Cleanup and recovery costs for this release totaled $767,000,000.

Using the EPA BOSCEM, the estimated total damage cost for this release is approximately $307,900,000. This total damage cost, *Cd*, includes the response cost, *Cr*, the socioeconomic damage cost, *Cs*, and the environmental damage cost, *Ce*, determined as follows.

Response cost, *Cr* = unit response cost □ medium modifier (Wetland) = $5,166 □ 1.6 = $8,265/barrel

Socioeconomic damage cost, *Cs* = unit socioeconomic cost □ socioeconomic cost modifier (High) = $2,940 □ 1.0 = $2,940/barrel

Environmental damage cost, *Ce* = unit environmental cost □ 0.5 □ [freshwater modifier (Wildlife Use) + wildlife modifier (Wetland)] = $1,470 □ 0.5 □ (1.7 + 4.0) = $4,190/barrel

Total damage cost (2004 basis), *Cd* = 20,000 barrels □ ($8,265 + $2,940 + $4,190)/barrel = $307,900,000.

After adjusting for inflation, the total damage cost (2012 basis), *Cd* = $307,900,000 □ 1.25 (inflation factor) = $384,875,000 which is approximately 50% of the actual cost.

Case Study 2 – Yellowstone 2011

A 12-in. hazardous liquid pipeline owned by ExxonMobil Pipeline Company ruptured on July 1, 2011 under the Yellowstone River 20 miles upstream from Billings, Montana. The Yellowstone River is navigable water in the United States (EPA, 2011). The ruptured pipeline released an estimated 1,509 barrels of oil that entered the river before the pipeline was closed. Cleanup and recovery costs for this release totaled $135,000,000.

The estimated total damage cost for this release is $48,044,000 based on 2004 cost data. This total damage cost, *Cd*, includes the response cost, *Cr*, the socioeconomic damage cost, *Cs*, and the environmental damage cost, *Ce*, determined as follows.

Response cost, *Cr* = unit response cost □ medium modifier (Wetland) = $8,190 □ 1.6 = $13,104/barrel.

Socioeconomic damage cost, *Cs* = unit socioeconomic cost □ socioeconomic cost modifier (Very High) = $5,880 □ 1.7 = $9,996/barrel.

Environmental damage cost, *Ce* = unit environmental cost □ 0.5 □ [freshwater modifier (Wildlife Use) + wildlife modifier (Wetland)] = $3,066 □ 0.5 □ (1.7 + 4.0) = $8,738/barrel. Total damage cost (2004 basis), *Cd* = 1,509 barrels □ ($13,104 + $9,996 + $8,738)/barrel = $48,044,000

After adjusting for inflation, the total damage cost (2012 basis), Cd = $48,044,000 □ 1.25 (inflation factor) = $60,054,000 which is approximately 44% of the actual cost.

Damage Cost Adjustment Factor

For this study, total damage costs of hazardous liquid pipeline releases are determined using the EPA BOSCEM and then increased by a damage cost adjustment factor of 2.1. This factor aligns the model with cleanup and recovery costs for two recent hazardous liquid pipeline releases of crude oil into sensitive socioeconomic and environmental areas.

3.3.4 Risk Analysis Results for Hazardous Liquid Pipeline Releases

The methodology for assessing socioeconomic and environmental damage to HCAs is based on computed release volumes corresponding to the detection, continued pumping, block valve closure, and drain down phases of a hazardous liquid pipeline release of crude oil without ignition. The method used in this analysis for defining maximum flow rate through the break is as defined in 49 CFR 195.105(b)(1) for the detection, pump shut down, block valve closure, and drain down phases. The damage is quantified using the EPA BOSCEM and the damage cost adjustment factor described in Section 3.3.3.

Eight case studies involving hypothetical hazardous liquid pipeline releases in HCAs are considered to assess effects of block valve closure time on socioeconomic and environmental damage resulting from a guillotine-type break. The duration of the detection and continued pumping phases for the hypothetical hazardous liquid pipelines are 5 minutes and 5 minutes, respectively. The duration of the block valve closure phases is 3 minutes. . . . . .

Characteristics for Case Study 8A, 8B, 8C, and 8D that involve 36-in. nominal diameter hazardous liquid pipelines are tabulated in Table 3.32. These case studies compare the following effects on avoided damage costs.

□ Case studies 8A and 8B compare effects of block valve closure swiftness on the avoided damage costs for hypothetical 36-in. nominal diameter hazardous liquid pipelines with MAOPs equal to either 400 psig or 1,480 psig, an elevation change of 100 ft, a drain down length of 3 mi., and block valve closure durations of 3, 30, 60, and 90 minutes.

□ Case studies 8C and 8D compare effects of block valve closure swiftness on the avoided damage costs for hypothetical 36-in. nominal diameter hazardous liquid pipelines with MAOPs equal to either 400 psig or 1,480 psig, an elevation change of 1,000 ft, a drain down length of 3 mi., and block valve closure durations of 3, 30, 60, and 90 minutes.

□ Case studies 8A and 8C compare effects of block valve closure swiftness on the avoided damage costs for hypothetical 36-in. nominal diameter hazardous liquid pipelines with MAOPs equal to 400 psig, an elevation change equal to either 100 ft or 1,000 ft, a drain down length of 3 mi., and block valve closure durations of 3, 30, 60, and 90 minutes.

□ Case studies 8B and 8D compare effects of block valve closure swiftness on the avoided damage costs for hypothetical 36-in. nominal diameter hazardous liquid pipelines with MAOPs

equal to 1,480 psig, an elevation change equal to either 100 ft or 1,000 ft, a drain down length of 3 mi., and block valve closure durations of 3, 30, 60, and 90 minutes.

Figures 3.82 to 3.85 list the discharge volumes in barrels for Case Study 8A, 8B, 8C, and 8D. Discharge volumes listed in Table 3.32 for each case study are determined by adding the discharge volumes for the detection (5 minutes), continued pumping (5 minutes), block valve closure (3, 30, 60, and 90 minutes), and drain down (3 miles) phases. Avoided damage costs, which are also listed in Table 3.32, represent the differences between the discharge volumes for the various block valve closure durations and the 3 minute block valve closure duration multiplied by the avoided damage unit cost. The total damage unit cost for these case studies is estimated at $29,520 per barrel. This total damage cost is the sum of the response cost plus the socioeconomic damage cost plus the environmental damage cost. Note that the avoided damage costs are not sensitive to pressure and elevation changes because the model is based on the methodology in 49 CFR §194.105 (b) (1) for a worst case discharge which has a constant flow rate.

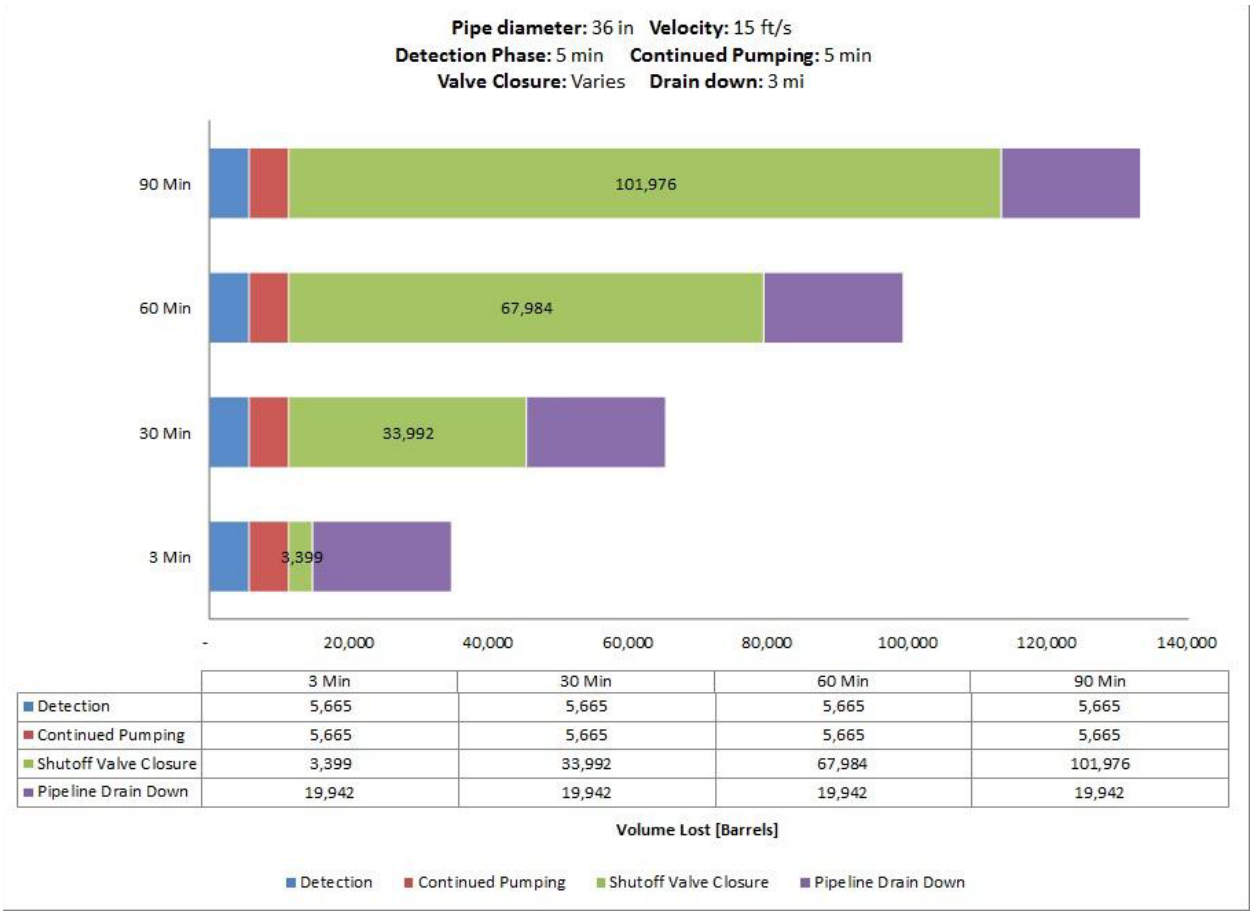
Benefits of Block Valve Closure Swiftness for a Hypothetical Hazardous Liquid Pipeline Releases without Ignition

The swiftness of block valve closure has a significant effect on mitigating potential socioeconomic and environmental damage to the human and natural environments resulting from hazardous liquid pipeline releases. The benefit in terms of cost avoidance for damage to the human and natural environments attributed to block valve closure swiftness increases as the duration of the block valve shutdown phase decreases.

Table 3.32. Effects of hypothetical 36-in. hazardous liquid pipeline releases without ignition Characteristic	**Case Study 8A**	**Case Study 8B**	**Case Study 8C**	**Case Study 8D**
Type Hazardous Liquid	Crude Oil	Crude Oil	Crude Oil	Crude Oil
Flow Velocity, ft/s	15	15	15	15
Nominal Line Pipe Diameter, in.	36	36	36	36
Drain Down Length, mi.	3	3	3	3
MAOP, psig	400	1,480	400	1,480
Elevation Change, ft	100	100	1,000	1,000
Detection Phase	5	5	5	5

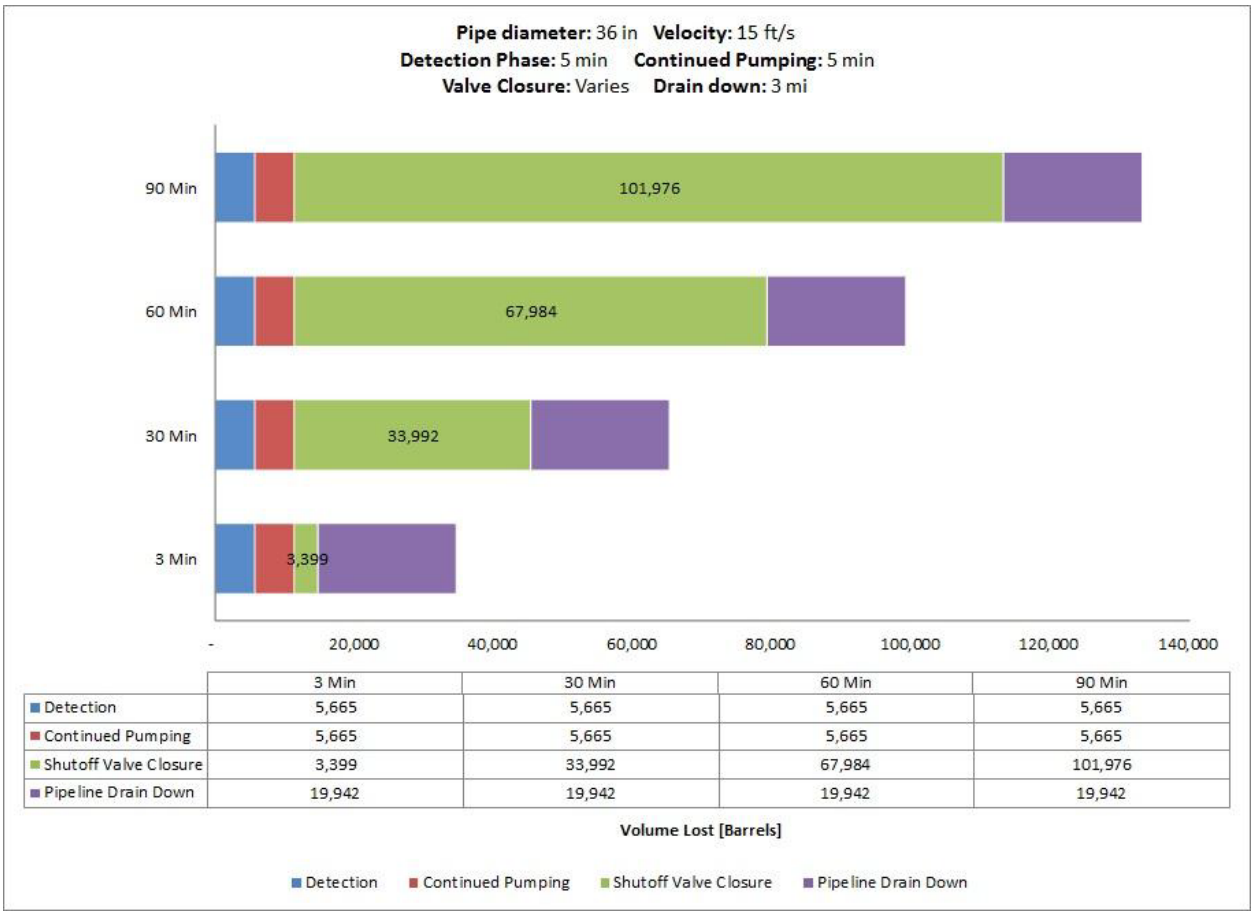
Duration, minutes				
Continued Pumping Phase Duration, minutes	5	5	5	5
Unit Response Cost, $/barrel	3,864	3,864	3,864	3,864
Medium Modifier (Wetland)	1.6	1.6	1.6	1.6
Response Cost, Cr	6,182	6,182	6,182	6,182
Unit Socioeconomic Cost, $/barrel	2,520	2,520	2,520	2,520
Socioeconomic Cost Modifier (Very High)	1.7	1.7	1.7	1.7
Socioeconomic Damage Cost, *Cs*	4,284	4,284	4,284	4,284
Unit Environmental Cost, $/barrel	1,260	1,260	1,260	1,260
One half Freshwater Modifier (Wildlife Use = 1.7) and Wildlife Modifier (Wetland = 4.0)	2.85	2.85	2.85	2.85
Environmental Damage Cost, *Ce*	3,591	3,591	3,591	3,591
Total Damage Unit Cost, *Cd*, $/barrel	14,057	14,057	14,057	14,057
Damage Cost Adjustment Factor for Hazardous Liquid Pipeline Releases	2.1	2.1	2.1	2.1
Total Damage	**29,520**	**29,520**	**29,520**	**29,520**

Unit Cost on 2012 Basis, $/barrel				
Detection Phase Release, barrels	5,665	5,665	5,665	5,665
Continued Pumping Phase Release, barrels	5,665	5,665	5,665	5,665
Drain Down Phase Release, barrels	19,942	19,942	19,942	19,942
Block Valve Closure Phase for Valve Closure in 3 minutes, barrels	3,399	3,399	3,399	3,399
Block Valve Closure Phase for Valve Closure in 30 minutes, barrels	33,992	33,992	33,992	33,992



	3 Min	30 Min	60 Min	90 Min
Detection	5,665	5,665	5,665	5,665
Continued Pumping	5,665	5,665	5,665	5,665
Shutoff Valve Closure	3,399	33,992	67,984	101,976
Pipeline Drain Down	19,942	19,942	19,942	19,942

Fig. 3.82. Case Study 8A – Discharge volumes for a 36-in. hazardous liquid pipeline with a 400 psig MAOP and an elevation change of 100 ft with a 3, 30, 60, and 90 minutes block valve closure phase.



	3 Min	30 Min	60 Min	90 Min
Detection	5,665	5,665	5,665	5,665
Continued Pumping	5,665	5,665	5,665	5,665
Shutoff Valve Closure	3,399	33,992	67,984	101,976
Pipeline Drain Down	19,942	19,942	19,942	19,942

Fig. 3.83. Case Study 8B – Discharge volumes for a 36-in. hazardous liquid pipeline with a 1,480 psig MAOP and an elevation change of 100 ft with a 3, 30, 60, and 90 minutes block valve closure phase.

APPENDIX 2. ADDITIONAL MAY 28 2014 COMMENTS TO THE MINNESOTA DEPARTMENT OF COMMENTS DURING THE ROUTE PERMIT HEARINGS FROM PAUL STOLEN

May 28 , 2014

Paul Stolen
37603 370th Av SE,
Fosston, MN 56542
218-435-1138

Mr. Larry Hartman
Environmental Review Manager
Minnesota Department of Commerce
85 67th Place East, Suite 500
St. Paul, MN 55101

Re: Comments on proposed Enbridge Sandpiper Pipeline, Minnesota Public Utilities Commission (PUC) Docket #13-474

Dear Mr. Hartman:

Enclosed are my additional comments on this proposed project based on the time extension previously granted. The attached material covers the following topics:

I. A copy of my updated April 4 2014 comments to correct minor editing problems and a request that you replace it with the enclosed comments.

II. The Scope of Work for the consultant to the PUC that will be doing the environmental analysis and route comparison.

III. The environmental "footprint" of the proposed pipeline. Enbridge continues to maintain that the project will require a 100 foot right of way (ROW). A report entitled "Construction of the Northern Border Pipeline in Montana" is enclosed that refutes Enbridge's position on ROW requirements, and shows that it only applies to flat terrain.

IV. Additional comments regarding the consequences of pipeline ruptures and leaks. This comment expands on my April 4 comments that these consequences need to be consider in assessment of impacts, location decisions, and need for the project.

V. Additional comments on the "corridor fatigue" issue.

If you have any questions, please give me a call.

Sincerely,

Paul Stolen

C: Tom Landwehr, Commissioner, Minnesota DNR
John Linc Stine, Commissioner, Minnesota PCA
Tamara Cameron, Regulatory Chief, Corps of Engineers

Additional comments on proposed Enbridge Sandpiper Pipeline, Minnesota Public Utilities Commission Docket #13-474
Paul Stolen
May 28 2014

I**. Corrected April 4 comments**. My previous comments, submitted on April 4, 2014, were sent in a rush. I had a computer hang-up at the last minute and therefore didn't have time for a final proofing on the paper copy. Therefore, I did a corrected copy, which is enclosed. I'd appreciate it if you would replace the April 4 copy with the enclosed. There were some typos and a few confusing sentences that I clarified. The most substantive correction was a small correction of numbers in Table 1. The cover letter of the enclosed corrected copy has a note about this below the signature line. I apologize for any confusion this may cause.

II. Scope of work for PUC consultant doing the environmental analysis and comparison of routes. My understanding is that the PUC will be hiring a private party to develop the environmental analysis and comparison of routes for Sandpiper. The product of this contracted work will thus be key to government decisions on this project. How will the Scope of Work be developed? Is such a scope of work shown to Enbridge prior to its completion? My comments and those of others need to be incorporated into the Scope of Work. This Scope of Work should include specific questions focused on the key public policy decisions that need to be made about the Sandpiper project, rather than allowing the contractor to determine such questions. In addition, a draft of this Scope of Work should be available for review prior to letting the contract, since the product is so crucial to the decisions.

The rules regarding a Certificate of Need for this project clearly indicate that environmental and socioeconomic factors must be taken into account in the decision as to whether to grant a need certificate. (Section 7853.0130, Criteria.) Therefore, the Scope of Work is a key document for determining whether to grant a Certificate of Need.

III**. Pipeline construction environmental "footprint**."

A. <u>Enbridge estimate the environmental "footprint" of the Sandpiper project is inaccurate</u>. Enbridge's statement that they use a 100 foot ROW to construct the project seriously underestimates the project's effects and potential for long term damage. In fact, such a ROW only applies to flat or nearly flat areas, and are often farmland.

The environmental study and route comparison must use accurate figures on land requirements for building the pipeline. The estimate must include the topics of land clearing, earth moving and excavation, soil compaction, and potential for topsoil mixing. This is called the project's "environmental footprint." During a public meeting on Sandpiper at Clearbrook, a recent visit

to the DNR, and the Enbridge documents on the PUC web site, I examined Enbridge's plan sheets and some applications for crossing streams. These plans are simply not accurate with respect to land clearing and extent of excavation.

Note: My comments here do not apply to the topic of "extra work space" at roads, river crossings, and a few other locations of specialized construction. Enbridge generally does include these locations on its plan sheets. Such locations are a small fraction of the ROW impacts beyond the 100-foot ROW in hilly terrain.

In spite of abundant evidence to the contrary, Enbridge continues to maintain to the public that it only needs a 100 foot right-of-way (ROW.) Enbridge also used this figure on the Alberta Clipper and Southern Lights Projects, even though during construction a much wider ROW was evident at some locations. Finally, the 100 foot ROW was also used for the MinnCan project as a guide to estimating the environmental footprint of the project. (I worked on all three projects while employed at the DNR, including conducting training for other DNR staff in pipeline construction.)

Both Enbridge and MinnCan did not provide accurate figures for excavation into parent material outside of the pipeline trench. Such excavation is abundant in hilly terrain. A key mitigation measure, topsoil separation in such areas, was ignored in many locations except for agricultural land.

The 100 foot ROW width does not apply to hilly terrain. It is time to put it to rest when large diameter pipelines are proposed in Minnesota. In fact, the construction ROW in hilly terrain can become 200 to 300 feet wide in some areas. In many cases on the three large, above-mentioned projects I was involved while at the DNR, these wider locations were never included in plains submitted for public review by the PUC, DNR, or PCA, and not included in calculations of the project's environmental footprint.

The terrain crossed by the proposed Sandpiper route crosses hilly glacial moraine in many locations Understanding pipeline construction in non-flat terrain is crucial because it directly relates to important environmental impacts such as the extent of land clearing, deep excavation outside of the pipe trench and accompanying potential serious loss of topsoil, susceptibility to invasion of non-native species and noxious weeds, and chronic erosion problems because re-vegetation is slower when topsoil is lost and replaced by parent material.

<u>B. Detailed explanation of ROW requirements for construction of a large-diameter pipeline.</u>

The enclosed report entitled "Construction of the Northern Border Pipeline in Montana" (referred hereafter as the IPTF Report) describes in detail why construction in non-flat terrain can lead to ROWs much wider than 100 feet. It also demonstrates why there can be extensive excavation outside of the pipeline trench. I wrote it (with review by supervisors) some years ago while Assistant Coordinator of the Montana Interagency Pipeline Task Force. One of the main reasons why it was written is because ROW was an important public issue for two proposed large pipelines in Montana. One of them, the Northern Tier Pipeline, was proposed to

cross the entire state, a distance of approximately 600 miles. A detailed review of it was done, but it was never built.

The Northern Border project—a 42 inch gas pipeline—crossed 180 miles of NE Montana, and was built after an EIS was prepared. ROW of way width was generally limited to 100 feet on state lands during the permitting stage, with the consent of the pipeline company. However, during construction, it became abundantly clear that it was impossible to construct the pipeline in such a narrow area in hilly terrain.

1. Purpose of IPTF Report. This report is applicable to the Sandpiper project with respect to determining the project's environmental footprint. It had four main purposes:

a. To document the ROW width in hilly terrain compared to flat terrain, and to determine the minimum ROW for a large diameter pipeline,

b. To document the locations of, and reasons for, excavation into topsoil and parent material outside the pipeline trench, since during the review period prior to construction the pipeline company had indicated excavation only for the pipe trench.

c. To identify problems encountered during construction and reclamation after pipe burial.

d. To serve as a training manual for reviewers of proposals to construct large diameter pipelines.

2. Caveats as to use of the IPTF report for the Sandpiper project. Before pointing out key findings of the report that relate to the Sandpiper proposal, there a few caveats as to its use:

a. Northern Border was constructed on a new ROW, with no existing pipelines in place.

b. A level work pad generally 50 feet wide is needed for construction of large diameter pipelines, with the pipeline trench to the left of the forward movement of construction. This work pad is essentially a road during construction, with nearly all traffic confined to it. Width is needed for passage of traffic past active work areas, and also for worker safety. A *level* work pad is necessary for worker safety and equipment needs. This construction necessity is directly related to the environmental footprint of the project as discussed below.

c. There have been some changes in pipeline construction techniques since Northern Border, but essentially none that affect ROW width except at special areas such as rivers. (Examples include: welding methods are done somewhat differently, and machine welding is often done on-site; cathodic protection pipe coating is no longer done on site, as depicted in the report, except at field welding locations; and directional drill bores (HDD) are much more common.) The fact that Northern Border was a 42 inch pipeline made little difference in ROW width as compared to the 24 inch MinnCan pipeline. The ROW for the latter was perhaps 8-10 feet narrower on flat terrain than the Northern Border line, but there was little difference on hilly

terrain. In addition, there have been changes in river crossing techniques with greater use of HDDs, and dam and pump methods are often used rather than open cut trenches.

d. When another large pipeline is added to an existing corridor, it is offset from the existing line by a project-specific distance. I've found it to be 35-40 as a minimum separation. Therefore, the construction ROW can be somewhat narrower than the standard 100 foot because spoil from the trench can be placed in the separation zone. However, there are site specific issues on hilly terrain so that generalizations don't work in such areas. Also, heavy equipment travel is restricted over the new and old lines.

e. Pipe is bent to *generally* follow the terrain, but not *exactly* follow the terrain. A straight pipe transfers gas or liquid most efficiently. Therefore, in hilly terrain with abrupt slopes, pipe curvature strikes a balance between the desire for a straight pipe and the constraints of excavation. In other words, in some locations, such as the crest of a hill, or under a small but steep hill, the pipe is buried much more deeply in order to lessen the curves. The report illustrates the result of this in expanded ROW width in some locations for the extra spoil and topsoil storage.

f. Topsoil separation in excavated areas is a crucial environmental issue because it relates to whether there are long-term impacts to land productivity in all areas, increased invasive species and noxious weeds, and increased erosion because re-vegetation is slow or non-existent. Topsoil separation can increase the ROW width because of separate piles; however, the expansion can be reduced by creative soil storage. Lack of topsoil separation causes long-term impacts whereas a somewhat wider ROW in some places causes temporary impacts. Furthermore, in recognition of this, topsoil separation has become a standard good practice in stormwater permits and all sorts of construction.

g. When done correctly based on known best practices for pipeline construction, environmental impacts of pipeline placement (not including future oil spill impacts) can be significantly reduced. The attached report suggests some of the good practices.

<u>3.Key points from IPTF report</u>. The IPTF report in its entirety is part of my comments, but the following are key points especially related to Sandpiper:

a. ROW requirements and topsoil stripping. Pages 31-32 provide a summary of the significance of ROW requirements as an environmental issue. It also references the details that support my findings that the IPTF Report is completely relevant to the Sandpiper project.

b. ROW requirements on flat terrain are discussed on page 33, and shown in pictures 51 and 52. On entirely flat terrain, it was possible to construct on an 85 foot ROW, although this increased somewhat as work progressed through clean-up.

c. Separation of topsoil from parent material on side-hill cuts is shown on page 37, and pictures 58 and 60. Page 39, picture 62, depicts lack of topsoil separation where it should have been done.

d. Page 40, and pictures 64 and 67 show deep side hill cuts, topsoil separation, and parent material storage.

e. Page 43 and photos 69-73 show extra-deep pipe burial in hilly areas and resulting large amounts of spoil.

f. Page 47-55 describe in detail why ROWs are wider than 100 feet in hilly terrain, and include diagrams explaining why this happens with respect to how pipelines must be constructed. The following significant conclusions are reached:

"1) Any deviation from flat terrain (0 degree slope) causes a geometric increase in width requirements, primarily for soil and spoil storage.

"2) There is often a progressive increase in r-o-w width after initial r-o-w clearing as different stages of construction proceed.

"3) there were numerous areas of extra r-o-w width needed beyond the 100 foot requested by DNRC.

"4) There was a high potential for topsoil mixing in the numerous side-hill cuts.

"6) Construction crews demonstrated an exceptional ability to re-contour the disturbed surface to the original configuration and replace topsoil when it had been correctly stripped.

IV. Consequences of pipeline leaks and ruptures must enter into route comparison, assessment of impacts, and need for the project.

My April 4 comments (pages 3 through 11) indicated in detail why impacts of pipeline leaks and ruptures need to be addressed in PUC decisions. I reiterate those recommendations, and have additional points regarding federal rules, and analysis of existing corridors, as follows:

A. Problems with federal rules. There are federal rules regarding hazardous liquid pipelines effects on the environment and people. These pipeline integrity rules pertain to environmental and socioeconomic impacts . They are administered by the Pipeline and Hazardous Materials Safety Administration (PHMSA) in the U.S. Department of Transportation. These rules refer to High Consequence Areas (HCA) and Unusually Sensitive Areas (USAs). (Title 49: Transportation PART 195—TRANSPORTATION OF HAZARDOUS LIQUIDS BY PIPELINE.) Both of these categories refer to populated areas, some aquifers, and some ecologically sensitive areas. I referred to HCAs in my April 4, 2014 comments.

The problem is that the federal rules regarding USAs and HCAs very much "high-grade" sensitive environmental features, and only include the rarest and most unusual ecological or natural resource features. This is not just my opinion. Describing sensitive area—and making lists of them—has been standard regulatory practice for many years. Such areas are subsequently avoided, or if they cannot be avoided, various mitigation measures are incorporated into government permits to reduce impacts. For example, these lists include public

lands dedicated to a public use such as parks and wildlife management areas, and critical habitat features for certain species, such as deer wintering areas.

One would expect that such normalized lists would have been incorporated into the PHMSA rules. *PHMSA did not even begin to do so.* The notice of the adoption of final rules noted that government agencies with much more expertise than PHMSA regarding pollution and natural resources, such as the EPA and US Department of Interior, strongly objected to the restricted list of USAs and HCAs. (See Federal Register / Vol. 65, No. 232 / Friday, December 1, 2000 / Rules and Regulations.) Many other commenters, including the US Department of Justice also objected to this limited list.

In spite of these objections, the Office of Pipeline Safety didn't budge and kept the limited list with little justification.

However, in 2011, Congress passed the Pipeline Safety Act, and it was signed into law in early 2012. This was in response to the Michigan Enbridge pipeline rupture, the explosion of a gas pipeline in California that killed 8 people, and other pipeline accidents. Now, PHMSA Administrator Cynthia Quarterman noted in a hearing last week in the US House of Representatives that new rules will be out for review shortly regarding USAs and HCAs and other rules regarding pipeline integrity and potential environmental impact.

<u>B. PUC route comparison with respect to USAs and HCAs</u> . The PUC route comparison needs to identify and compare:

1. Any USAs and HCAs as defined in *current* federal pipeline integrity rules on any of the routes that have been identified or are being studied.

2. Any USAs and HCAs—or other categories related to the environment—*as defined in proposed new rules* on any of the routes being studied and identified, assuming the new proposed rules come out in time.

3. Determine the effects on any USAs or HCAs should there be a pipeline rupture, based on the "worst case" as defined in the Oak Ridge National Laboratory 2012. "Studies for the Requirements of Automatic and Remotely Controlled Shutoff Valves on Hazardous Liquids and Natural Gas Pipelines with Respect to Public and Environmental Safety" December 2012. This should also incorporate a "worst case" regarding collateral damage to existing pipelines in the two corridors that already have multiple pipelines.

<u>C. Collective facility plan</u>. Enbridge is the owner of all of the lines in its mainline corridor to Superior. In other words, it collectively owns all the pipelines in most of this corridor. Enbridge should be required to submit a Facility Plan for the Mainline Corridor, and any other corridor that contains more than one Enbridge line. This should be in addition to the plans on each individual line. Such plans can provide indications of responses to spills constrained by existing lines, as well as be indicative of "corridor fatigue."

V. Additional comments on the analysis of "corridor fatigue" issues. My April 4 comments addressed "corridor fatigue" on pages 11-16, with recommendations on pages 15-16. I have the following additional comments.

The route comparison simply must address the growing problem of adding more and more pipelines to existing corridors that were established prior to environmental laws. Therefore, the key place to begin is in the contractor hired by the PUC. Information about the existing pipelines and corridors will aid in understanding the extent of "corridor fatigue" and the increased risk of accidents on one line cascading to others. Therefore, the Scope of Work for the PUC contractor should specifically require the contractor include at least the following with respect to existing corridors:

A. Information about existing lines. On each existing line this should include: locations, identification of any looped areas, locations of cross-overs, types of river crossings such as whether they are trenched or bored, and extent of cover in the riverbed if trenched. There are also a number of locations along the Enbridge Mainline where pipelines actually are not next to each other, which results in multiple corridors somewhat close together rather than one corridor.

B. Facility plans on existing lines. Federal rules require that a "facilities plan" be submitted by a pipeline company prior to its being built. According to a call to the state office of pipeline safety, these are sent to PHMSA, and are not filed with the Minnesota agency. These plans are to include such items as the company's risk assessment, identification of HCAs and USAs, and other content highly relevant to an assessment of impacts and a comparison of routes.

C. Locations of problems areas identified during construction of existing lines. Enbridge and MinnCan should provide information on problem areas identified during construction of the existing lines.

D. Identify "choke points." There are locations along existing corridors where it is simply not physically possible to add more pipelines. These are sometimes referred to as "choke points." Such areas are indicative of "corridor fatigue," and are also the reason for the divergence noted in #2 above.

E. Locations where existing pipelines are exposed or more vulnerable to damage. Pipelines constructed in the past were built to lesser standards than current pipelines. For instance, Enbridge Line 3 was placed on the surface of the ground in certain wetland locations and cover piled on top of it. Over time, this has resulted in pipe exposure. Federal rules do not require that older pipelines meet current standards; therefore, Enbridge has been re-covering such locations on a voluntary basis. These locations should be identified. Also, I am aware of at least one, and possibly two locations along the Enbridge corridor where pipe is exposed as it crosses a river. One of these is a trout stream in Beltrami County.

Such locations are more vulnerable to vandalism and environmental events such as large and unusual rainfall events. Therefore, these locations along the existing corridors increase the risk of ruptures and accidents which may cause increased risk to new lines. The contractor needs to

obtain from Enbridge and MinnCan records that identify such areas, and include this factor in assessing "corridor fatigue" and the route comparison.

F. Rivers and floodplains crossed at an oblique angle. Such important natural resource areas should be crossed by pipelines in a perpendicular manner in order to minimize the length of crossing this feature. This would be done when a new corridor is established. Therefore, data on oblique crossings is a measure of existing corridor problems. The LaSalle Creek crossing north of Itasca Park is a good example of this problem. A good measure of each crossing is the distance crossed obliquely compared to the perpendicular distance of the same crossing.

G. Avoidance areas under current pipeline construction practices. The existing corridors should be assessed to determine locations that would have been avoided if the existing pipelines were not present. Admittedly, this assessment would be somewhat objective. However, there are such features as lakes crossed by pipelines on the existing corridor. It is highly unlikely such features would be crossed by a new pipeline corridor. Also, a new pipeline corridor could well be routed around at least some wetlands rather than the numerous wetland crossing now found on the old corridors proposed to be followed by Enbridge's new lines.

H. Areas of restricted access. The existence of buried lines actively interfering with response to pipeline ruptures can reduce response time because heavy equipment can't drive over lines in some locations. In addition, pipeline ruptures in areas with few roads likely would exacerbate spills. The existing corridors should be examined to find such areas.

APPENDIX 3. CONSTRUCTION OF THE NORTHERN BORDER PIPELINE IN MONTANA
REPORT OF INTERAGENCY PIPELINE TASK FORCE

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
JANUARY 1982
BY PAUL STOLEN

This report is too big to include here. However, it has been submitted to the Department of Commerce in a timely fashion during the Route Permit proceedings. It was entered in eDocket 13-474 on July 18, 2014 in 4 pieces

APPENDIX 4, NEWS STORY REGARDING ENBRIDGE FILING OF NEW FIGURES ON COST OF PIPELINE RUPTURE

New price tag for Kalamazoo River oil spill cleanup: Enbridge says $1.21 billion
By Garret Ellison | gellison@mlive.com
on November 05, 2014 at 1:45 PM, updated November 05, 2014 at 1:48 PM

MARSHALL, MI — The largest inland oil spill in U.S. history has cost Canadian energy giant Enbridge $1.21 billion to clean up — a substantially higher figure than previously estimated.

In a securities filing this week, Enbridge Energy Partners reported the total cleanup cost of the 2010 Kalamazoo River oil spill to be $85.9 million higher than figures released last year. According to the Securities and Exchange Commission filing, the $1.21 billion figure included $551.6 million spent on response personnel and equipment, $227 million on environmental consultants and $429.4 million on professional, regulatory, and other costs. The company estimates it has $219 million in spill costs yet-to-be-paid.

The new numbers follow substantial cleanup activities and restoration of the Kalamazoo River, which was fouled by 843,000 gallons of diluted bitumen, or dilbit, a viscus type of heavy crude oil from the tar sands region of Canada. The spill occurred when a six-foot break in Enbridge's Line 6B, which runs from Griffith, Ind., to Sarnia, Ontario, sent oil into the river's Tallmadge Creek tributary near Marshall on July 25, 2010.

Portions of the river were dredged and riverbank was restored with native plantings along the entire 35-mile stretch of waterway in Calhoun and Kalamazoo counties. Dredging near Ceresco and Morrow Lake is being completed. On Oct. 9, the Michigan Department of Natural Resources reported that all sections of the river had reopened for public use.

The U.S. Dept. of Transportation fined Enbridge $3.7 million dollars after the spill. The U.S. Environmental Protection Agency is expected to levy additional fines for violations of the Clean Water Act. In the filing, Enbridge estimates those to be around $40 million. The Michigan Department of Environmental Quality is taking over responsibility for monitoring and remediation of remaining submerged oil from the EPA.

On Oct. 21, U.S. District Judge Gordon Quist approved an undisclosed settlement between Enbridge and developers who planned to convert 420 acres of undeveloped land in Marshall into a $14 million community vineyard. In a Nov. 3 earnings call, Enbridge president Mark Maki said the company increased its insurance liability coverage to $700 million following the 2010 spill.

"If you go back over our history, the Marshall incident was without question really a confluence of a number of very, very difficult and bad events in terms of what it cost ultimately," Maki said. "So we just don't see a lot of value in ensuring for another Marshall.."

Garret Ellison covers business, government and breaking news for MLive/The Grand Rapids Press. Email him at gellison@mlive.com or follow on Twitter & Instagram

APPENDIX 5.

JULY 30 2012 LETTER FROM PHMSA TO ENBRIDGE INC REGARDING CORRECTIVE ACTION ORDER ON 24-INCH LINE 14 IN WISCONSIN BECAUSE OF RUPTURE THAT OCCURRED JULY 2012.

APPENDIX 6

AUGUST 1, 2012
LETTER FROM PHMSA TO ENBRIDGE INC REGARDING AMENDED CORRECTIVE ACTIONS ORDER ISSUED FOR THE 24-INCH LINE 14 IN WISCONSIN.

Note: These two documents cannot be pasted into this testimony document; therefore, they are appended as separate documents to the testimony

U.S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration

JULY 30 2012

1200 New Jersey Avenue, SE
Washington, D.C. 20590

VIA CERTIFIED MAIL AND FAX TO: 832-325-5473

Mr. Richard Adams
Vice President, US Operations
Enbridge Energy, LP
City Center Office
1409 Hammond Avenue
Superior, WI 54880-5247

Re: CPF No. 3-2012-5017H

Dear Mr. Adams:

Enclosed is a Corrective Action Order issued in the above-referenced case. It finds that operation of the 24-inch diameter Line 14 would be hazardous to life, property, and the environment without immediate corrective action. The Corrective Action Order requires you to take certain corrective actions to protect the public, property, and the environment in connection with the failure of Line 14 that occurred on July 27, 2012, near Grand Marsh, Wisconsin. Service is being made by certified mail and facsimile. Your receipt of this Corrective Action Order constitutes service of that document under 49 C.F.R. § 190.5. The terms and conditions of this Order are effective upon receipt.

We look forward to the successful resolution of the concerns arising out of this failure in a manner that will ensure the safe operation of the pipeline. Please direct any questions on this matter to David Barrett, Director, Central Region, OPS, at (816) 329-3800.

Sincerely,

Jeffrey D. Wiese
Associate Administrator
for Pipeline Safety

Enclosure: Corrective Action Order and Copy of 49 C.F.R. §190.233

cc: Mr. Alan Mayberry, Deputy Associate Administrator for Field Operations, OPS
Mr. David Barrett, Director, Central Region, OPS
Mr. Mark Maki, President, Enbridge Energy Management, LLC
Mr. Steve Wuori, President, Liquids Pipelines, Enbridge Pipelines Inc.

U.S. DEPARTMENT OF TRANSPORTATION
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION
OFFICE OF PIPELINE SAFETY
WASHINGTON, D.C. 20590

In the Matter of	)	
Enbridge Energy, LP,	)	**CPF No. 3-2012-5017H**
Respondent.	)	

CORRECTIVE ACTION ORDER

Purpose and Background

This Corrective Action Order (Order) is being issued, under authority of 49 U.S.C. § 60112, to Enbridge Energy, LP (Enbridge or Respondent), the operator of the 24-inch diameter hazardous liquid pipeline designated as Line 14 that runs from Respondent's Superior Terminal and pump station in Superior, Wisconsin, to its Mokena delivery facility in Mokena, Illinois (Affected Pipeline). This Order finds that continued operation of the pipeline without corrective action would be hazardous to life, property, or the environment and requires Respondent to take immediate corrective action to ensure the safe operation of the pipeline.

On July 27, 2012, Respondent experienced a failure on the Affected Pipeline near Grand Marsh, WI (Failure), in Adams County. Respondent estimates the volume of product spilled to be approximately 1,200 barrels of crude oil.

Pursuant to 49 U.S.C. § 60117, the Pipeline and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS), initiated an investigation of the Failure. OPS has determined that the release originated from the Affected Pipeline but the cause of the Failure has not yet been determined. The preliminary findings of the investigation are as follows:

Preliminary Findings

- The Affected Pipeline originates at the Superior Terminal in Wisconsin, proceeds southeast for approximately 467 miles, and terminates at the Mokena delivery facility near Chicago, Illinois.

- At approximately 2:41 pm CDT on July 27, 2012, Respondent's control center staff noted indications of a release on the Affected Pipeline. Respondent initiated shut down of the pipeline and notified field personnel in Wisconsin at 3:00 pm CDT.

- At approximately 2:45 pm CDT on July 27, 2012, Respondent received a call from a landowner who reported that crude oil was spraying on the pipeline right-of-way. The local sheriff's office also called the control center at 2:50 pm CDT.

- At approximately 2:55 pm CDT on July 27, 2012, Respondent isolated the failed pipe section by closing remotely controlled valves located upstream and downstream of the Failure site.

- At 3:27 pm CDT on July 27, 2012, Respondent's field personnel confirmed the location of the Failure as being approximately 5.7 miles east of Grand Marsh, Wisconsin, at 2487 County Road G in Adams County. The Failure site was located at milepost (M.P.) 232 on the Affected Pipeline.

- At 5:16 pm CDT on July 27, 2012, Respondent notified the National Response Center of the discharge of crude oil (NRC Report No. 1019189). Respondent reported 1,200 barrels of crude oil were released.

- Two households were evacuated due to their proximity to the Failure site. Several cattle and horses required veterinary attention. No further injuries cahave been reported.

- The Affected Pipeline crosses multiple rivers, including a navigable waterway, i.e., the Illinois River in the Chicago area, and intersects multiple High Consequence Areas (HCAs), including drinking water sources, "Other Populated Areas," "High Population Areas," and ecological resources. The Affected Pipeline also crosses numerous state highways in Wisconsin and Illinois, and multiple interstate highways before terminating at Mokena, Illinois.

- The Failure site is 2.5 miles away from a drinking water source, which so far shows no signs of contamination.

- The Affected Pipeline was constructed in 1998 of 24-inch, API 5L grade X70, high frequency electric resistance welded (ERW) pipe manufactured by the Stupp Pipe Corporation, with wall thicknesses ranging from 0.328-inch to 0.500-inch. The pipe at the Failure site has a 0.328-inch nominal wall thickness. The Affected Pipeline has a fusion bonded epoxy coating and an impressed-current cathodic protection system.

- Just prior to the time of the Failure, the discharge pressure at the Adams pump station (M.P. 227.4), located approximately 4.6 miles upstream of the Failure site, was 1,329 psig. The established maximum operating pressure (MOP) of the pipeline is 1,378 psig.

- Respondent performed a hydrostatic test of the pipeline in 1998 from M.P. 227.49 to M.P. 253.15 to a test pressure of 1,875 psig, which included the Failure site.

- The cause of the Failure is unknown but PHMSA has is continuing an onsite investigation. PHMSA investigators observed a 4.18-foot-long split in the high

frequency ERW seam of the pipe with a maximum opening of 6.25 inches. The pipeline currently remains out of service.

- During construction of the Affected Pipeline in 1998, radiography of girth welds revealed lack-of-fusion defects in the ERW seams at multiple locations along the Affected Pipeline.

- On January 1, 2007, a rupture of the Affected Pipeline occurred in Atwood, Wisconsin, releasing 1,500 barrels of crude oil. The rupture was located at M.P. 149.4, approximately one mile downstream of Respondent's Owen pump station in Clark County, Wisconsin. The OPS investigation of the 2007 failure found that a pre-existing lack-of-fusion defect in the ERW seam had grown to failure by a fatigue mechanism due to cyclic loads and that the chemical and mechanical properties of the pipe joint fracture surface also had indications of low toughness of the ERW seam.

- Following the January 1, 2007 failure, Respondent utilized ultrasonic crack detection technology to assess the Affected Pipeline. Multiple crack anomalies associated with the ERW seam were reported by the inline inspection (ILI) vendor. Based on the ILI results, Respondent made repairs to the Affected Pipeline for a 1.25 x MOP factor of safety. Calculations performed by Respondent in 2008 predicted that Line 14 would not fail for a minimum of 10 years based on a crack growth analysis that considered the operating pressure spectrum.

- Respondent performed an ILI of the Affected Pipeline in the area of the Failure in 2011 utilizing high-resolution geometry and magnetic flux leakage (MFL) tools. An ultrasonic crack detection technology ILI inspection was scheduled to be performed in the area of the failure in August 2012.

- The history of failures on Respondent's Lakehead Pipeline system, of which the Affected Pipeline is a part, the defects originally discovered during construction, and the 2007 failure indicate that Respondent's integrity management program may be inadequate.

Determination of Necessity for Corrective Action Order and Right to Hearing

Under 49 U.S.C. § 60112 and 49 C.F.R. § 190.233, the Associate Administrator for Pipeline Safety (Associate Administrator) may issue a corrective action order after providing reasonable notice and the opportunity for a hearing if he finds that a particular pipeline facility is or would be hazardous to life, property, or the environment. The terms of such an order may include the suspended or restricted use of a pipeline facility, physical inspection, testing, repair, replacement, or any other action as appropriate. The Associate Administrator may also issue a corrective action order without providing any notice or the opportunity for a hearing if he finds that a failure to do so expeditiously will result in likely serious harm to life, property or the environment. The opportunity for a hearing will be provided as soon as practicable after the issuance of the CAO in such cases.

After evaluating the foregoing preliminary findings of fact, I find that the continued operation of the pipeline without corrective measures would be hazardous to life, property and the environment. Additionally, after considering the age and failure history of the pipe, the circumstances surrounding the Failure, the proximity of the pipeline to populated areas, water bodies, drinking water resources, public roadways, and High Consequence Areas, the hazardous nature of the product being transported, the uncertainties as to the cause of the Failure, and the ongoing investigation to determine the cause of the Failure, I find that a failure to issue this Order expeditiously to require immediate corrective action would likely result in serious harm to life, property, and the environment. Accordingly, this Corrective Action Order is issued without prior notice and opportunity for a hearing. The terms and conditions of this Order are effective upon receipt.

Within 10 days of receipt of this Order, Respondent may request a hearing, to be held as soon as practicable, by notifying the Associate Administrator for Pipeline Safety in writing, delivered personally, by mail or by fax at (202) 366-4566. The hearing will be held in Kansas City, Missouri, or Washington, DC, on a date that is mutually convenient to PHMSA and Respondent.

After receiving and analyzing additional data in the course of this investigation, PHMSA may identify other corrective measures that need to be taken. Respondent will be notified of any additional measures required and amendment of this Order will be considered. To the extent consistent with safety, Respondent will be afforded notice and an opportunity for a hearing prior to the imposition of any additional corrective measures.

Required Corrective Action

Pursuant to 49 U.S.C. § 60112, Enbridge Energy, LP, is ordered to immediately take the following corrective actions to ensure the safe operation of the Affected Pipeline:

1. Develop and submit a written re-start plan for prior approval of the Director, Central Region, OPS (Director). Obtain written approval from the Director prior to resuming operation of the Affected Pipeline. Submit the written plan to the Director at the Pipeline and Hazardous Materials Safety Administration, 901 Locust Street, Suite 462, Kansas City, MO 64106-2641. The plan must provide for adequate patrolling of the Affected Pipeline during the restart process to ensure the prompt detection of leaks, include a daylight restart, and detail advance communications with local emergency response officials.

2. After receiving approval from the Director to restart, maintain a minimum twenty percent (20%) pressure reduction in the operating pressure of the Affected Pipeline. Submit the operating pressures for each pump station on the Affected Pipeline at the time of failure and the reduced discharge pressure limits for approval by the Director in the restart plan referenced in Item 1. The reduced discharge pressure limits must also consider any ILI features and anomalies that are present in the Affected Pipeline to provide for continued safe operation while further corrective actions are completed. The approved pressure restrictions will remain in effect until written approval to increase the pressure or return the pipeline to its pre-failure operating pressure is obtained from the Director pursuant to

Item 12. Respondent must maintain documentation to show that these requirements have been met.

Review the pressure restrictions monthly, taking into account any ILI features present in the pipeline and analysis of operating pressure cycle data. Based on the monthly review, Enbridge must immediately reduce operating pressure accordingly to maintain safe operations. Submit results of the monthly review, the current discharge set points, including any additional reductions, and any exceedance of discharge set points, in the reports pursuant to Item 10.

3. Within 45 days of receipt of this Order, complete mechanical and metallurgical testing and failure analysis of the failed pipe and other pipe removed, including analysis of soil samples and any foreign materials. Complete the testing and analysis as follows:

   A. Document the chain-of-custody when handling and transporting the failed pipe section and other evidence from the failure site;

   B. Submit the testing protocols and the selection of the testing laboratory to the Director for prior approval.

   C. Prior to commencing the mechanical and metallurgical testing, provide the Director with the scheduled date, time, and location of the testing to allow a PHMSA representative to witness the testing; and

   D. Ensure that the testing laboratory distributes all resulting reports in their entirety (including all media), whether draft or final, to the Director at the same time as they are made available to Respondent.

4. Within 30 days of receipt of this Order, conduct an evaluation of the previous inline inspection (ILI) results, including a review and reporting by the ILI vendors' analysts (including raw data) of the Affected Pipeline as follows:

   A. Submit any and all reports from the 2007 ILI runs as received from the vendors;

   B. Re-evaluate the 2007 inline inspection results to determine whether any features were present in the failed pipe joint and other pipe removed. Determine if any features with similar characteristics are present elsewhere on the Affected Pipeline. Submit to the Director the scheduled dates, times, and locations of meetings with the ILI vendors to allow PHMSA representatives to attend;

   C. Submit a report describing the ILI features present in the failed joint and other pipe removed, the process used to re-evaluate ILI results, and the results of the re-evaluation including characterization of the size and location of similar features on the Affected Pipeline.

5. As recommended in PHMSA Advisory Bulletin 2012–06, verify the records for the Affected Pipeline relating to operating specifications for maximum operating pressure

(MOP). Within 45 days of receipt of this Order, submit a report on this record verification and copies of these records to the Director.

6. Within 90 days following receipt of this Order, complete an evaluation utilizing multiple root cause failure analysis techniques, including a Management Oversight and Risk Tree (MORT) analysis, to determine the underlying causes and contributing factors to the Failure, including preventive measures employed by Enbridge. Within 10 days of receipt of this Order, submit a list of proposed independent third-party contractors for prior approval by the Director, along with contractor qualifications and scope of work. The scope of the evaluation must include, but not be limited to: Enbridge's procedures; failure, operating and maintenance history; use of safety factors; review of ILI results; application of assessment methods, analysis and monitoring of pressure cycles in determining assessment intervals and operating pressures; decision processes regarding repair methods, including pipe replacement; a detailed review of the adequacy of the operator's spill prevention plans; and a detailed review of all emergency response activities, including initial controller response. All reports in their entirety (including all media), whether draft or final, shall be submitted to the Director at the same time they are made available to Respondent. Submit the final report for the Director's approval.

7. Within 90 days following receipt of this Order, submit an integrity verification and remedial work plan (Work Plan) for implementing continuing long-term periodic testing to the Director for approval. The Work Plan must provide for the verification of the integrity of the pipeline and must address all factors known or suspected in the July 27, 2012 failure, including, but not limited to the following:

   A. The integration of the results of the failure analyses and other actions required by this Order, with all relevant operating data, including all historical repair information, construction, operating, maintenance, testing, metallurgical analysis or other third-party consultation information, and assessment data for the Affected Pipeline. Data gathering activities must include a review of the failure history of the pipeline (including in-service and pressure test failures) and development of a written report to be approved by the Director containing all available information regarding locations, dates, and causes of leaks and failures;

   B. The performance of additional field testing, inspections, and evaluations to determine whether and to what extent the conditions associated with the failures, or any other integrity-threatening conditions are present elsewhere on the Affected Pipeline. At a minimum, the inspections and evaluations must consider use of in-line inspection that can reliably detect and identify anomalies. Include a detailed description of the criteria to be used for the evaluation and prioritization of any integrity threats and anomalies that are identified (accounting for uncertainties in anomaly and defect sizing by the ILI vendor and field non-destructive examination), establishing a minimum 1.39 x MOP factor of safety upon completion of testing, inspections, evaluations, replacements and repairs as described in this Order;

C. The performance of repairs or other corrective measures that fully remediate the conditions associated with the pipeline failures and any other integrity-threatening condition everywhere along the Affected Pipeline. The plans must be based on the known history and condition of the pipeline, and must be scheduled to be completed as follows: (1) repairs must be completed within 6 months of receipt of the ILI vendor's final report; (2) confirmatory hydrostatic pressure testing of the Affected Pipeline by December 31, 2013; and (3) replacement of the Affected Pipeline or portions thereof by July 31, 2015. Include a detailed description of the criteria and methods to be used in undertaking any repairs, replacements, or other remedial actions to establish a minimum 1.39 x MOP factor of safety.

8. The approved Work Plan will be incorporated into this Order. Respondent must revise the Work Plan as necessary to incorporate the results of actions undertaken pursuant to this Order and whenever necessary to incorporate new information obtained during the failure investigation and remedial activities. Submit any such plan revisions to the Director for prior approval. The Director may approve plan elements incrementally.

9. Implement the Work Plan as it is approved by the Director, including any revisions to the plan.

10. Submit monthly reports to the Director that: (1) include all available data and results of the testing and evaluations required by this Order; and (2) describe the progress of the repairs or other remedial actions being undertaken. The first monthly report for the period from August 1 through August 31, 2012 shall be due by September 7, 2012.

11. It is requested that Respondent maintain documentation of the costs associated with implementation of this Corrective Action Order. Include in each monthly report submitted, the to-date total costs associated with: (1) preparation and revision of procedures, studies and analyses; (2) physical changes to pipeline infrastructure, including repairs, replacements and other modifications; and (3) environmental remediation, if applicable.

12. The Director may allow the removal or modification of the pressure restriction set forth in Item 2 upon a written request from Respondent demonstrating that the hazard has been abated and that restoring the pipeline to its pre-failure operating pressure is justified based on a reliable engineering analysis showing that the pressure increase is safe considering all known defects, anomalies and operating parameters of the pipeline.

The Director may grant an extension of time for compliance with any of the terms of this Order upon a written request timely submitted demonstrating good cause for an extension.

With respect to each submission that under this Order requires the approval of the Director, the Director may: (a) approve, in whole or part, the submission; (b) approve the submission on specified conditions; (c) modify the submission to cure any deficiencies; (d) disapprove in whole or in part, the submission, directing that Respondent modify the submission, or (e) any combination of the above. In the event of approval, approval upon conditions, or modification by the Director, Respondent must take all actions required by the submission as approved or

modified by the Director. If the Director disapproves all or any portion of the submission, Respondent must correct all deficiencies within the time specified by the Director, and resubmit it for approval. If a resubmitted item is disapproved in whole or in part, the Director may again require Respondent to correct the deficiencies in accordance with the foregoing procedure, and the Director may otherwise proceed to enforce the terms of this Order.

Be advised that all material you submit in response to this enforcement action is subject to being made publicly available. If you believe that any portion of your responsive material qualifies for confidential treatment under 5 U.S.C. 552(b), you must provide, along with the complete original document, a second copy of the document with those portions you believe qualify for confidential treatment redacted, along with an explanation of why you believe the redacted information qualifies for confidential treatment under 5 U.S.C. 552(b).

In your correspondence on this matter, please refer to "CPF No. 3-2012-5017H" and for each document you submit, please provide a copy in electronic format whenever possible. The actions required by this Corrective Action Order are in addition to and do not waive any requirements that apply to Respondent's pipeline system under 49 C.F.R. Part 195, under any other order issued to Respondent under authority of 49 U.S.C. § 60101 et seq., or under any other provision of Federal or State law.

Respondent may appeal any decision of the Director to the Associate Administrator for Pipeline Safety. Decisions of the Associate Administrator shall be final.

Failure to comply with this Order may result in the assessment of civil penalties and in referral to the Attorney General for appropriate relief in United States District Court pursuant to 49 U.S.C. § 60120.

The terms and conditions of this Corrective Action Order are effective upon receipt.

Jeffrey D. Wiese
Associate Administrator
for Pipeline Safety

7/30/2012
Date Issued

U.S. Department
of Transportation

**Pipeline and Hazardous
Materials Safety
Administration**

AUG 1, 2012

1200 New Jersey Avenue, SE
Washington, D.C. 20590

VIA CERTIFIED MAIL AND FAX TO: 832-325-5473

Mr. Richard Adams
Vice President, US Operations
Enbridge Energy, LP
City Center Office
1409 Hammond Avenue
Superior, WI 54880-5247

Re: CPF No. 3-2012-5017H
Amendment to the July 30, 2012 Corrective Action Order

Dear Mr. Adams:

Enclosed is an Amendment to the Corrective Action Order that was issued in the above-referenced case on July 30, 2012. Your receipt of this Amendment constitutes service of that document under 49 C.F.R. § 190.5.

Please direct any questions on this matter to David Barrett, Director, Central Region, Office of Pipeline Safety, PHMSA, at (816) 329-3800.

Sincerely,

Jeffery Wiese
Associate Administrator
For Pipeline Safety

Enclosures: Amendment to the Corrective Action Order
Copy of 49 C.F.R. § 190.233

cc: Mr. Alan Mayberry, Deputy Associate Administrator for Field Operations, OPS
Mr. David Barrett, Director, Central Region, OPS
Mr. Mark Maki, President, Enbridge Energy Management, LLC
Mr. Steve Wuori, President, Liquids Pipelines, Enbridge Pipelines Inc.

U. S. DEPARTMENT OF TRANSPORTATION
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION
OFFICE OF PIPELINE SAFETY
WASHINGTON, DC 20590

In the Matter of	)	
Enbridge Energy, LP,	)	**CPF No. 3-2012-5017H**
Respondent.	)	

AMENDMENT TO THE CORRECTIVE ACTION ORDER

Background and Purpose

On July 30, 2012, under authority of 49 U.S.C. § 60112, the Associate Administrator for Pipeline Safety, Pipeline and Hazardous Materials Safety Administration (PHMSA), issued a Corrective Action Order (CAO) to Enbridge Energy Partners, LP (Enbridge or Respondent), finding that continued operation of Respondent's Line 14 that runs from Superior, Wisconsin, to Mokena, Illinois, without corrective action would be hazardous to life, property, or the environment and requiring Respondent to take immediate corrective action to ensure the safe operation of the pipeline. PHMSA issued the July 30, 2012 CAO (Original CAO) [1] in response to a failure on Line 14 near Grand Marsh, Wisconsin, that was reported by Enbridge on July 27, 2012 (Failure). The Failure resulted in an estimated release of 1,200 barrels of crude oil. PHMSA initiated an investigation of the Failure which is ongoing.

Line 14 is a part of Respondent's 1,900 mile-long Lakehead Pipeline system, which transports hazardous liquid from Neche, North Dakota, to Chicago, Illinois, with an extension to Buffalo, New York.[2]

Additional Preliminary Findings

The preliminary findings in the Original CAO noted that the history of failures on Respondent's Lakehead Pipeline system, the defects originally discovered during construction of Line 14, a 2007 failure on Line 14, and the July 2010 failure on Line 6B in Marshall, Michigan, and additional failures throughout all parts of the Lakehead System indicate that Respondent's integrity management program may be inadequate. PHMSA has communicated its longstanding

[1] *In the Matter of Enbridge Energy Partners, L.P.*, Corrective Action Order (CPF No. 3-2012-5017H) dated July 30, 2012.

[2] *See* http://www.enbridgeus.com/Delivering-Energy/Pipeline-Systems/Liquids-Pipelines/ (last accessed August 1, 2012). The Lakehead System includes Lines 1, 2, 3, 4, 5, 6A, 6B, 10, 14, and 64, and associated facilities.

concerns about this pattern of failures with Respondent over the past several years. Given the nature, circumstances, and gravity of this pattern of accidents, additional corrective measures are warranted.

Finding of Hazardous Condition

Section 60112 of Title 49, United States Code, provides for the issuance of a Corrective Action Order, including amendments, after reasonable notice and the opportunity for a hearing, requiring the operator of a pipeline determined to pose a hazard to take corrective actions to protect the public and the environment. These may include the suspended or restricted use of a pipeline facility, physical inspection, testing, repair, replacement, or other action, as appropriate. The basis for making a determination that a pipeline facility is or would be hazardous, requiring corrective action, is set forth both in the above-referenced statute and 49 C.F.R. § 190.233, a copy of which is enclosed.

After evaluating all available information regarding the safety of the Lakehead System, including the foregoing additional preliminary findings, and considering the nature and circumstances surrounding the Failure, the hazardous nature of the product transported, the pressure required for transporting such product, and the ongoing investigation to determine the root cause of the Failure, I find that the continued operation of the Line 14 without additional corrective measures would be hazardous to life, property, and the environment.

Accordingly, PHMSA hereby issues this Amendment to the CAO requiring the additional actions specified herein be taken to protect life, property, and the environment. The additional actions set forth in this Amendment to the CAO are in addition to the actions set forth in the Original CAO and do not suspend or eliminate the requirements of the Original CAO, unless otherwise specifically provided herein.

Amendments to Required Corrective Action

Pursuant to 49 U.S.C. § 60112 and 49 C.F.R. § 190.233, Enbridge Energy Partners, L.P. is ordered to comply with this Amendment to the CAO and take the following additional corrective actions with respect to the Lakehead System. The following item is added to the Corrective Action Order:

13. Before the Director, Central Region, OPS, approves the restart of Line 14, Enbridge must (1) submit, for review and approval, a comprehensive written plan, including timelines for specific actions to improve the safety record of Respondent's Lakehead pipeline system and (2) hire an independent third party pipeline expert to review and assess the written plan, which the third party will submit to PHMSA and to Respondent concurrently. Further, the third party expert must oversee the creation, execution and implementation of the actions identified in the plan, and must provide monitoring summaries to PHMSA and Respondent concurrently. Respondent must commit to address any deficiencies or risks identified in the third party's assessment, including repair and replacement of high-risk infrastructure.

    The plan must be sufficiently detailed with specific tasks, milestones and completion dates. At a minimum, the plan must address:

a. Organizational issues, including the promotion of a safety culture and creation of a safety management system;
b. Facilities response plan;
c. Control room management;
d. Priorities for pipe replacement;
e. Training;
f. In-line inspection result interpretation;
g. Current engineering and probability of failure modeling;
h. Leak detection systems;
i. Sensor and flow measuring and valve replacement;
j. Integrity verification;
k. Quality management system; and
l. Any other risk, task, issue or item that is necessary to promote and sustain the safety of its pipeline system.

The actions required by this Amendment to the CAO are in addition to and do not waive any requirements that apply to Line 14 under the Original CAO or to Respondent's pipeline system under 49 C.F.R. Parts 190 through 199, as applicable, or any other Order issued to Respondent under authority of 49 U.S.C. § 60101 et seq., or under any other provision of federal or state law.

After receiving and analyzing additional data in the course of this investigation, PHMSA may identify other corrective actions that need to be taken. In that event, Respondent will be notified of any additional measures required and further amendment of the CAO will be considered. To the extent consistent with safety, Respondent will be afforded notice and an opportunity for a hearing prior to the imposition of any additional corrective measures.

Jeffrey D. Wiese
Associate Administrator
for Pipeline Safety

AUG 01 2012
Date Issued