Tar Sands Pipelines Safety Risks

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Natural Resources Defense Council
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Executive Summary

Tar sands crude oil pipeline companies may be putting America's public safety at risk. Increasingly, pipelines transporting tar sands crude oil into the United States are carrying diluted bitumen or "DilBit"—a highly corrosive, acidic, and potentially unstable blend of thick raw bitumen and volatile natural gas liquid condensate—raising risks of spills and damage to communities along their paths. The impacts of tar sands production are well known. Tar sands extraction in Canada destroys Boreal forests and wetlands, causes high levels of greenhouse gas pollution, and leaves behind immense lakes of toxic waste. Less well understood, however, is the increased risk and potential harm that can be caused by *transporting* the raw form of tar sands oil (bitumen) through pipelines to refineries in the United States.

Currently, tar sands crude oil pipeline companies are using conventional pipeline technology to transport this DilBit. These pipelines, which require higher operating temperatures and pressures to move the thick material through a pipe, appear to pose new and significant risks of pipeline leaks or ruptures due to corrosion, as well as problems with leak detection and safety problems from the unstable mixture. There are many indications that DilBit is significantly more corrosive to pipeline systems than conventional crude. For example, the Alberta pipeline system has had approximately sixteen times as many spills due to internal corrosion as the U.S. system. Yet, the safety and spill response standards used by the United States to regulate pipeline transport of bitumen are designed for conventional oil.

DilBit is the primary product being transported through existing pipelines in the Midwest and would be transported in a proposed pipeline to the Gulf Coast. DilBit pipelines threaten ecologically important lands and waters from the Great Lakes to the Ogallala Aquifer. Moreover, the United States is on a path to lock itself into a long-term reliance on pipelines that may not be operated or regulated adequately to meet the unique safety requirements for DilBit for decades to come.

There are several steps that the United States can and should take in order to prevent future DilBit pipeline spills. These precautionary steps are essential for protecting farmland, wildlife habitat, and critical water resources—and should be put in place before rushing to approve risky infrastructure that Americans will be locked into using for decades to come:

- **Evaluate the need for new U.S. pipeline safety regulations.** Older safety standards designed for conventional oil may not provide adequate protection for communities and ecosystems in the vicinity of a DilBit pipeline. The Department of Transportation (DOT) should analyze and address the potential risks associated with the transport of DilBit at the high temperatures and pressures at which those pipelines operate and put new regulations in place as necessary to address these risks.
- **The oil pipeline industry should take special precautions for pipelines transporting DilBit.** Until appropriate regulations are in place, oil pipeline companies should use the appropriate technology to protect against corrosion of their pipelines, to ensure that the smallest leaks can be detected in the shortest time that is technologically possible, and companies should ensure sufficient spill response assets are in place to contain a spill upon detection.
- **Improve spill response planning for DilBit pipelines.** Spill response planning for DilBit pipelines should be done through a public process in close consultation with local emergency response teams and communities.
- **New DilBit pipeline construction and development should not be considered until adequate safety regulations for DilBit pipelines are in place.** The next major proposed DilBit pipeline is TransCanada's Keystone XL pipeline. This pipeline approval process should be put on hold until the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) evaluates the risks of DilBit pipelines and ensures that adequate safety regulations for DilBit pipelines are in place.
- **Reduce U.S. demand for oil, especially for tar sands oil.** The United States can dramatically cut oil consumption by reinforcing existing reduction programs, such as efficiency standards for vehicles, and through new investments in alternatives to oil.

INTRODUCTION

Tar sands crude oil pipeline companies may be putting America's public safety at risk as pipelines transporting tar sands crude oil into the United States are increasingly carrying a more abrasive and corrosive mix—diluted bitumen or "DilBit"—raising risks of spills and damage to communities along their paths. While the impacts of tar sands production are well known—destruction of Boreal forests and wetlands, high levels of greenhouse gas pollution, and immense amounts of toxic waste—less well known is the increased risk and potential harm that can be caused by transporting the raw form of tar sands oil (bitumen) through pipelines to refineries in the United States.

In the past, the vast majority of tar sands bitumen was upgraded in Canada before coming into the United States as synthetic crude oil. However, more often now bitumen is diluted and piped to U.S. refineries after being strip mined or melted from the tar sands under Canada's Boreal forest in Alberta. Bitumen is not the same as conventional oil; it has characteristics that make it potentially more dangerous. Nonetheless, the safety and spill response standards used by the United States to regulate pipeline transport of bitumen are designed for conventional crude oil.

This report shows that with an increasing trend of more bitumen coming into U.S. pipelines, it is important that the American public understands the characteristics of bitumen in a pipe that are potentially a threat to health and safety. The United States needs to ensure that appropriate oil pipeline safety and spill response standards that address the higher risks associated with transporting corrosive and acidic bitumen are in place. Until these safety and spill response standards are adopted, the United States should put a hold on the consideration of new tar sands pipelines.

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A view of Lake Michigan, one of the treasured resources threatened by pollution from tar sands pipelines.

TAR SANDS MOVEMENT INTO THE UNITED STATES

Tar sands crude oil pipeline companies are using conventional pipeline technology to transport diluted bitumen or "DilBit," a highly corrosive, acidic, and potentially unstable blend of thick raw bitumen and volatile natural gas liquid condensate. In order to become usable transportation fuels, DilBit can only be processed by certain refineries that have built the capacity to handle very heavy crudes. With Canadian upgraders operating at full capacity, oil companies have started transporting more of the raw tar sands to U.S. refineries that can either already take the heavier oil or need to build additional upgrading capacity.

Historically, the United States has imported the majority of tar sands crude from Canada in the form of synthetic crude oil, a substance similar to conventional crude oil that has already gone through an initial upgrading process. Importing tar sands oil into the United States as DilBit—instead of synthetic crude oil—is a recent and growing development.[1] Without much public knowledge or a change in safety standards, U.S. pipelines are carrying increasing amounts of the corrosive raw form of tar sands oil. In fact, over the last ten years, DilBit exports to the United States have increased almost fivefold, to 550,000 barrels per day (bpd) in 2010—more than half of the approximately 900,000 bpd of tar sands oil currently flowing into the United States.[2] By 2019, Canadian tar sands producers plan to triple this amount to as much as 1.5 million bpd of DilBit.[3]

DilBit is the primary product being transported through the new TransCanada Keystone pipeline that runs from Alberta's tar sands to Illinois and Oklahoma,[4] and also through Enbridge's recently-built Alberta Clipper pipeline, which terminates in Wisconsin.[5] In addition, DilBit is transported through the existing Enbridge Lakehead system that brings both conventional oil and tar sands from the Canadian border to Minnesota, Wisconsin, Illinois, Indiana, and Michigan.

Transporting DilBit is also the primary purpose of TransCanada's proposed Keystone XL pipeline, which would run nearly 2000 miles from Alberta through some of America's most sensitive lands and aquifers on the way to refineries on the U.S. Gulf Coast.[6] This infrastructure will lock the United States into a continued reliance on pipelines that may not be operated or regulated adequately to meet the unique safety requirements for DilBit for decades to come.

Tar Sands Oil Extraction Risks

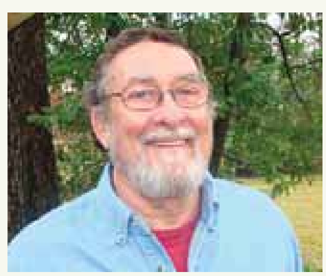
Bitumen deposits are found in Northeastern Alberta under Canada's Boreal forest and wetlands in an area approximately the size of Florida.[7] To extract the bitumen, the oil industry strip mines and drills millions of acres of sensitive wildlife habitat—disrupting critical terrestrial carbon reservoirs in peatlands. Because it requires large amounts of energy, production of synthetic crude oil from tar sands is estimated to release at least three times the greenhouse gas emissions per barrel as compared to that of conventional crude oil.[8] In addition to its high carbon costs, tar sands oil production:

- Requires two to five barrels of water for each barrel of bitumen extracted[9]
- Has already created over 65 square miles of toxic waste ponds[10]
- Threatens the health of downstream indigenous communities[11]
- Is likely to cause the loss of millions of migratory birds that nest in the forests and wetlands of the region[12]

Tar sands excavated through strip mining are processed with hot water to separate the bitumen from the sand and clay. In drilling, most companies use a method called steam-assisted gravity drainage (SAGD) where steam is pumped under the ground to melt the bitumen out of the sand so that it liquefies enough to be pumped out. Then, in both cases, the bitumen must be diluted with other material—allowing it to flow through a pipe to the upgrading and refining facilities.

© David Dodge, The Pembina Institute

Suncor Millenium Tar Sands Mine east of the Athabasca River.



© Anita Judice

"We're taking the Boreal forest and just trashing it for this dirty, heavy, ugly stuff. Let's make some solar panels and windmills. Let's do something clean."

– Paul Judice, educator and retired environmental engineer in Southeast Texas

DILBIT PIPELINE SAFETY CONCERNS

As tar sands oil companies send increasing volumes of DilBit to the United States, the risks of pipeline spills are becoming more apparent. DilBit pipelines, which require higher operating temperatures and pressures to move the thick material through a pipe, appear to pose new and significant risks of pipeline leaks or ruptures due to corrosion, as well as problems with leak detection and safety problems from the instability of DilBit. For example, in July 2010, an Enbridge tar sands pipeline spilled over 840,000 gallons of diluted bitumen into Michigan's Kalamazoo River watershed.[13]

DilBit's Characteristics Can Lead to Weakening of Pipelines

There are many indications that DilBit is significantly more corrosive to pipeline systems than conventional crude. Bitumen blends are more acidic, thick, and sulfuric than conventional crude oil. DilBit contains fifteen to twenty times higher acid concentrations than conventional crudes and five to ten times as much sulfur as conventional crudes.[14] It is up to seventy times more viscous than conventional crudes.[15] The additional sulfur can lead to the weakening or embrittlement of pipelines.[16] DilBit also has high concentrations of chloride salts which can lead to chloride stress corrosion in high temperature pipelines.[17] Refiners have found tar sands derived crude to contain significantly higher quantities of abrasive quartz sand particles than conventional crude.[18]

This combination of chemical corrosion and physical abrasion can dramatically increase the rate of pipeline deterioration.[19] Despite these significant differences, PHMSA does not distinguish between conventional crude and DilBit when setting minimum standards for oil pipelines.

The risks of corrosion and the abrasive nature of DilBit are made worse by the relatively high heat and pressure at which these pipelines are operated in order to move the thick DilBit through the pipe. Industry defines a high pressure pipeline as one that operates over 600 pounds per square inch (psi).[31] Due to the high viscosity or thickness of DilBit, pipelines—such as the Keystone tar sands pipeline—operate at pressures up to 1440 psi and at temperatures up to 158 degrees Fahrenheit.[32] In contrast, conventional crude pipelines generally run at ambient temperatures and lower pressures.

Higher temperatures thin the DilBit and increase its speed through the pipeline. They also increase the speed at which acids and other chemicals corrode the pipeline. An accepted industry rule of thumb is that the rate of corrosion doubles with every 20 degree Fahrenheit increase in temperature.[33] At high temperatures, the mixture of light, gaseous condensate, and thick, heavy bitumen, can become unstable.[34] Variations in pipeline pressure can cause the natural gas liquid condensate to change from liquid to gas form. This creates gas bubbles within the pipeline. When these bubbles form and collapse they release bursts of high pressure that can deform pipeline metal.[35] The instability of DilBit can render pipelines particularly susceptible to ruptures caused by pressure spikes.[36]

Leaks in DilBit Pipelines Can Be Difficult to Detect

Leaks in DilBit pipelines are often difficult to detect. As stated above, as DilBit flows through a pipeline, pressure changes within the pipeline can cause the natural gas liquid condensate component to move from liquid to gas phase.[37] This forms a gas bubble that can impede the flow of oil. Because this phenomenon—known as column

Diluted Bitumen's Characteristics

Characteristics	Conventional Crude[20]	Diluted Bitumen	Point of Reference
Acidity (Total Acid Number - TAN)	0-0.3[21]	0.856-4.32[22]	Refiners require special measures to prevent corrosion when processing crudes with a TAN greater than 0.5.[23]
Viscosity	5 Centistrokes (cST)	201 cST	Gasoline at the pump has a viscosity of 0.4–0.8 cST.[24]
Sulfur Content	0.34% - 0.57%[25]	3.37%	Gasoline has a sulfur content of less than 0.0000008.%
Pipeline Temperature	Less than 100° F[26]	158° F	Conventional crude pipelines tend to run at ambient temperatures.
Pipeline Pressure	600 pounds per square inch (psi)[27]	1440 psi	Industry defines a high pressure pipeline as one that operates at over 600 psi.[28]
Abrasives (quartz and silicates)	Nil	Keystone XL pipeline maximum capacity would mean over 125 pounds of quartz sand and aluminosilicates per minute.[29]	Common sandblasters use between 1.5 and 47 pounds of sand per minute.[30]

© National Transportation Safety Board

Section of pipe from Kalamazoo spill containing rupture. Rupture length is approx 6 ft 5 inches and is 4 1/2 inches wide at the widest location.

Safety of drinking water matters

Residents along the pipeline path put protection of their drinking water above arguments in favor of the proposed Keystone XL tar sands pipeline. Public opinion research, conducted recently by NRDC, shows deep concern about the possibility of tar sands pipelines leaking into water supplies, especially in Nebraska where the proposed Keystone XL tar sands pipeline would cross the Ogallala aquifer, a huge freshwater aquifer that provides drinking and agricultural water to eight states in the heartland of the United States. The research shows that residents believe investing in clean, renewable sources of energy is better than investing in a tar sands pipeline that will keep the United States reliant on oil into the future.

separation—presents many of the same signs as a leak to pipeline operators, real leaks may go unnoticed. Because the proper response to column separation is to pump more oil through the pipeline, misdiagnoses can be devastating.[38] During the Kalamazoo River spill, the Enbridge pipeline gushed for more than twelve hours before the pipeline was finally shut down, and initial investigation indicates that the pipeline's monitoring data were interpreted to indicate a column separation rather than a leak.[39] Ultimately, emergency responders were not notified until more than nineteen hours after the spill began.[40]

DilBit is Risky to the Environment and Human Health

DilBit poses an elevated risk to the environment and public safety once a leak has occurred. While all crude oil spills are potentially hazardous, the low flash point and high vapor pressure of the natural gas liquid condensate used to dilute the DilBit increase the risk of the leaked material exploding.[41] DilBit can form an ignitable and explosive mixture in the air at temperatures above 0 degrees Fahrenheit.[42] This mixture can be ignited by heat, spark, static charge, or flame.[43] In addition, one of the potential toxic products of a DilBit explosion is hydrogen sulfide, a gas which can cause suffocation in concentrations over 100 parts per million and is identified by producers as a potential hazard associated with a DilBit spill.[44] Enbridge identified hydrogen sulfide as a potential risk to its field personnel during its cleanup of the Kalamazoo River spill.[45]

DilBit contains benzene, polycyclic aromatic hydrocarbons, and n-hexane, toxins that can affect the human central nervous systems.[46] A recent report filed by the Michigan Department of Community Health found that nearly 60 percent of individuals living in the vicinity of the Kalamazoo River spill experienced respiratory, gastrointestinal, and neurological symptoms consistent with acute exposure to benzene and other petroleum related chemicals.[47] In addition to their short term effects, long term exposure to benzene and polycyclic aromatic hydrocarbons has been known to cause cancer.[48]

DilBit also contains vanadium, nickel, arsenic, and other heavy metals in significantly larger quantities than occur in conventional crude.[49] These heavy metals have a variety of toxic effects, are not biodegradable, and can accumulate in the environment to become health hazards to wildlife and people.[50]

DILBIT CLEANUP AND EMERGENCY RESPONSE

Clean up of DilBit poses special risks. The characteristics of DilBit create challenges for cleanup efforts in rivers and wetland environments. In the case of conventional oil spills, mechanical devices such as booms, skimmers, and sorbent materials—described by the Environmental Protection Agency (EPA) as the primary line of defense against oil spills in the United States—contain and recover oil floating on the water surface.[51] However, unlike conventional crude oils, the majority of DilBit is composed of raw bitumen which is heavier than water. Following a release, the heavier fractions of DilBit will sink into the water column and wetland sediments. In these cases, the cleanup of a DilBit spill may require significantly more dredging than a conventional oil spill.[52] Further, heavy oil exposed to sunlight tends to form a dense, sticky substance that is difficult to remove from rock and sediments.[53] Removing this tarry substance from river sediment and shores requires more aggressive cleanup operations than required by conventional oil spills.[54] These factors increase both the economic and environmental costs of DilBit spills.

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"I just don't understand why we'd put our aquifer at risk. If oil gets into the water, we're done. You can't drink oily water and you can't irrigate crops with it."

– Randy Thompson, Nebraska landowner whose ranch would be crossed by the Keystone XL pipeline

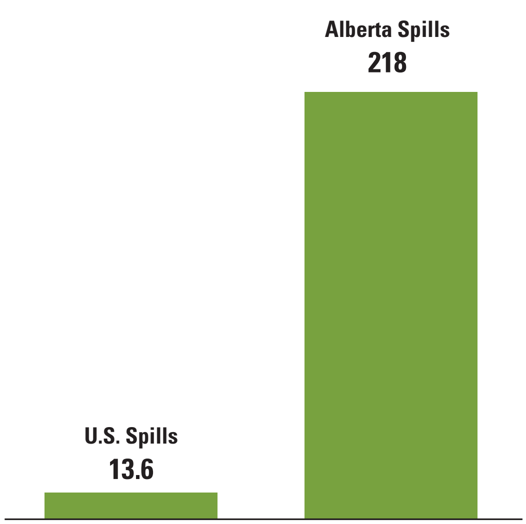
The containment and cleanup of a DilBit spill requires significant personnel, equipment, supplies, and other resources. The Kalamazoo River spill required more than 2000 personnel, over 150,000 feet of boom, 175 heavy spill response trucks, 43 boats, and 48 oil skimmers.[55] Federal regulations for crude oil pipeline spill response lack specific standards and mandatory equipment and personnel requirements, and are therefore much weaker than regulations for other polluters, such as oil tankers and oil refineries.[56] While the Kalamazoo River spill occurred in a populated area where residents could notify authorities of the spill and significant private spill response equipment was nearby, other DilBit pipelines cross significantly more remote areas.[57] In the entire area of Montana, Nebraska, North Dakota, and South Dakota, TransCanada—the operator of Keystone I and the proposed Keystone XL pipelines, and its private contractors—list a total of 8,000 feet of boom, eight spill response trailers, seven skimmers, and four boats available to respond to a spill.[58] Much of this equipment will take hours to transport on-site in the event of a spill in this large region.[59]

HISTORY OF DILBIT TRANSPORTATION IN CANADA RAISES SAFETY CONCERNS[60]

One indication of the potential additional hazards of DilBit to a pipeline is that the Alberta hazardous liquid pipeline system has a relatively high rate of pipeline failure from internal corrosion. While DilBit has not been common until recently in the United States pipeline system, it has composed a high proportion of the product on the Alberta pipeline system.[61] In Alberta, tar sands producers have been using DilBit pipelines since the 1980s to move raw bitumen to upgrading facilities. By 2009, over two-thirds of all crude produced in Alberta was transported as DilBit at some point in its production process.[62]

Over half of the pipelines currently operating in Alberta have been built in the last twenty years as the tar sands region developed.[63] In contrast, the majority of hazardous liquid pipelines in the United States are more than forty years old.[64]

Comparison of Pipeline Spills per 10,000 Miles Caused by Internal Corrosion between 2002 and 2010



Internal corrosion caused more than sixteen times as many spills in the Alberta pipeline system as the U.S. system.

The corrosive characteristics of DilBit may account for the disparity between spill rates in the United States and Alberta hazardous pipeline systems. Comparison of pipeline spills greater than 26 gallons per 10,000 miles of pipeline caused by internal corrosion on the Alberta and United States onshore hazardous liquid pipeline system between 2002 and 2010.[a]

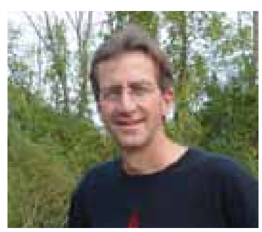
Source: NRDC Graph.

[a] Internal corrosion caused 8.9 percent of the spills greater than 26 gallons on the United States onshore hazardous liquid pipeline system between 2002 and 2010. "Distribution, Transmission, and Liquid Accident and Incident Data," U. S. Department of Transportation Pipeline and Hazardous Materials Safety Administration, 2002-2010, http://www.phmsa.dot.gov/portal/site/PHMSA/menuitem.ebdc7a8a7e39f2e55cf2031050248a0c/?vgnextoid=fdd2dfa122a1d110VgnVCM1000009ed07898RCRD&vgnextchannel=3430fb649a2dc110VgnVCM1000009ed07898RCRD&vgnextfmt=print (last accessed January 12, 2011). Internal corrosion caused 1257 of the 2705 spills greater than 26.3 gallons on the Alberta hazardous pipeline system. Of 468 incidents per 10,000 miles of Alberta pipelines, 46.5 percent, or 218 incidents per 10,000 miles, were caused by internal corrosion between 2002 and 2010.

© Richard Ruff

The older a pipeline is the more attention that a pipeline company needs to pay to it because it may not have the same type of coating, same strength of steel, or had corrosion protections for its entire life. Despite its relatively recent construction, Alberta's hazardous liquid system had 218 spills greater than 26 gallons per 10,000 miles of pipeline caused by internal corrosion from 2002 to 2010, compared to 13.6 spills greater than 26 gallons per 10,000 miles of pipeline from internal corrosion reported in the United States to PHMSA during that same time period.[65] This rate of spills due to internal corrosion is sixteen times higher in Alberta than in the United States.

While differences in data collection and regulations between Alberta and the United States make it impossible to make a clear comparison of this data, the higher internal corrosion rates in Alberta certainly raise the yet unanswered question of whether the properties that are unique to DilBit are apt to cause the same corrosion problems in the United States as more and more DilBit flows south.



© Lucas Hamilton

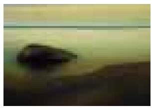
"I'm worried about oil that we can't clean up, residing in the soils and sediments, potentially being a slow source of contamination into the plants and animals and releasing into the river."

– Stephen Hamilton, professor of Aquatic Ecology at Michigan State University and the President of the Kalamazoo River Watershed Council

DILBIT PUTTING U.S. SPECIAL PLACES AT RISK[66]

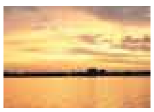
With more DilBit coming into the United States in pipelines built under conventional oil standards, it is important to understand the water resources, habitat, and wildlife at risk from existing DilBit pipelines throughout the Midwest as well as from the proposed Keystone XL pipeline to Texas.

1 Great Lakes


© Jimmy Brown

The Great Lakes are the largest source of freshwater in the world, and provide drinking water for 40 million American and Canadian citizens.[67] Enbridge pipelines that sometimes carry DilBit run through the Great Lakes region close to Lake Superior, Lake Michigan, Lake Huron, and Lake Erie.[68]

2 Lake St. Clair and the St. Clair River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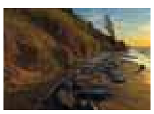
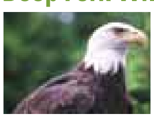
The St. Clair River provides drinking water for millions in Southeast Michigan and was threatened by a potentially faulty section of the Enbridge pipeline that runs under the river and is due to be replaced in early 2011.[69] The St. Clair River drains into Lake St. Clair, the Detroit River, and Lake Erie.

3 Indiana Dunes


© Tom Gill

Enbridge pipelines run near the biologically rich and recreationally important Indiana Dunes, on the southern shore of Lake Michigan.[70]

4 Deep Fork Wildlife Management Area



In Oklahoma, the proposed Keystone XL pipeline would cut through this 11,900 acre haven for game and non-game species, including Bobwhite Quail, turkeys, bobcats, and Bald Eagles.[71]

5 Native Prairies and the Threatened Topeka Shiner Minnow


© Joan Kovatch

In Kansas, the proposed Keystone XL pipeline would cross native prairies and may affect critically designated habitat for the federally endangered Topeka Shiner minnow.[72]

6 Whooping Crane and Sandhill Crane Habitat


© Phil Kates

The proposed Keystone XL pipeline would cross the Platte River in Nebraska, an important stop-over site on the migration path of the endangered Whooping Crane. Sandhill Cranes also use the area as a nesting site.[73]

7 Ogallala Aquifer

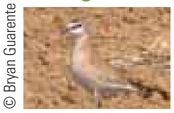

© Emily Andersen

The proposed Keystone XL pipeline crosses the Ogallala Aquifer, one of the world's largest freshwater aquifers that provides 30 percent of the ground water used for irrigation in the United States, and drinking water for millions of Americans. The aquifer covers areas in South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas.

8 Prairie Potholes and Migratory Birds

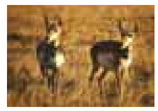
In South Dakota, the Keystone XL pipeline route tracks the Central and Mississippi migratory bird flyways, and cuts through the prairie pothole ecosystem that is critically important nesting and migratory staging areas for many ducks, including Pintails and Mallards.[74]

9 Shortgrass Prairie and Mountain Plover


© Bryan Guarente

The South Dakota Shortgrass prairie regions, through which the Keystone pipeline passes and the proposed Keystone XL pipeline would pass, are important habitat for the Mountain Plover, proposed for listing as threatened under the Endangered Species Act.[75]

10 Pronghorn Antelope Habitat



The Keystone XL pipeline would traverse pronghorn antelope habitat in Montana, further fragmenting already-threatened migration routes.[76] Pronghorn are a unique American species whose movements are very sensitive to roads and human activity.

SELECT RIVERS THREATENED BY UNITED STATES DILBIT PIPELINES

Missouri River

The longest river on the continent and the route of the Lewis and Clark expedition, the Missouri is crossed by pipelines in numerous places, including by Keystone pipeline on the South Dakota-Nebraska border and the Kansas-Missouri border, by Enbridge pipelines in Missouri, and by the proposed Keystone XL pipeline in Montana, near the relatively isolated Upper Missouri River Breaks National Monument.[77]

Yellowstone River

In Montana, the proposed Keystone XL pipeline would cross the Yellowstone River, a major tributary into the Missouri River and the longest undammed river in the lower 48 states. The river is of vital use for fishermen and recreationalists, and is a major irrigation source for farmers and ranchers.[78]

Mississippi River

The Keystone pipeline crosses the Mississippi River in Missouri, near the confluence of the Mississippi and Missouri Rivers, and terminates just across the river in Illinois. Enbridge pipelines cross the northern part of the Mississippi River in Minnesota.

Kalamazoo River

In Michigan, an Enbridge pipeline crosses the Kalamazoo River which flows into Lake Michigan. A spill from this pipeline has already damaged the river ecosystem and threatened nearby communities and the Great Lakes.[79]

Red River

The Red River serves an important breeding ground for the highly endangered Interior Least Tern, which requires feeding areas with shallow waters and an abundance of small fish.[80] The proposed Keystone XL pipeline would cross the Red River on the Oklahoma-Texas border.

Neches River

The Neches River is the last river in East Texas with abundant wildlife, clean water, scenic river vistas, and forests. The proposed Keystone XL pipeline would cross the Neches River in Texas.[81]


Hudson Bay
Fort McMurray
Alberta
Saskatchewan
Manitoba
Ontario
Edmonton
Hardisty
Calgary
Regina
Winnipeg
Missouri River
Helena
10
Montana
North Dakota
Bismarck
Yellowstone River
Lake Superior
Superior
Minnesota
Saint Paul
Wisconsin
Mississippi River
1
Lake Huron
Lake Ontario
Michigan
Lake Michigan
Kalamazoo River
Lake Erie
2
9
8
Pierre
South Dakota
Idaho
Wyoming
6
7
Nebraska
Ogallala Aquifer
Iowa
Chicago
3
Indiana
Ohio
Lincoln
Illinois
Utah
Colorado
Steele City
Springfield
Patoka
Wood River
St. Louis
West Virginia
Kansas
Topeka
5
Kentucky
Missouri
Arizona
New Mexico
Cushing
Oklahoma City
Tennessee
4
Oklahoma
Arkansas
Red River
Mississippi
Alabama
Georgia
Neches River
Louisiana
Austin
Texas
Port Arthur
Houston
Florida
Tar Sands Region
Keystone Pipeline
Proposed Keystone XL Pipeline
Enbridge Pipelines

ENSURING OUR SAFETY

There are several steps that the United States can and should take in order to prevent future DilBit pipeline spills. These precautionary steps are essential for protecting farmland, wildlife habitat, and critical water resources—and should be put in place before rushing to approve risky infrastructure that Americans will be locked into using for decades to come.

- **Evaluate the need for new U.S. pipeline safety regulations.** Older safety standards designed for conventional oil may not provide adequate protection for communities and ecosystems in the vicinity of a DilBit pipeline. The Department of Transportation should analyze and address the potential risks associated with the transport of DilBit at the high temperatures and pressures at which those pipelines operate and put new regulations in place as necessary to address these risks.
- **The oil pipeline industry should take special precautions for pipelines transporting DilBit.** Until appropriate regulations are in place, oil pipeline companies should use the appropriate technology to protect against corrosion of their pipelines, to ensure that the smallest leaks can be detected in the shortest time that is technologically possible, and companies should ensure sufficient spill response assets are in place to contain a spill upon detection.
- **Improve spill response planning for DilBit pipelines.** Spill response planning for DilBit pipelines should be done through a public process in close consultation with local emergency response teams and communities.
- **New DilBit pipeline construction and development should not be considered until adequate safety regulations for DilBit pipelines are in place.** The next major proposed DilBit pipeline is TransCanada's Keystone XL pipeline. This pipeline approval process should be put on hold until PHMSA evaluates the risks of DilBit pipelines and ensures that adequate safety regulations for DilBit pipelines are in place.
- **Reduce U.S. demand for oil, especially for tar sands oil.** The United States can dramatically cut oil consumption by reinforcing existing reduction programs, such as efficiency standards for vehicles, and through new investments in alternatives to oil.

U.S. pipelines are carrying increasing amounts of the corrosive raw form of tar sands oil under regulations meant for the less corrosive conventional oil.

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