Attachment A

ANIMAS-LA PLATA PROJECT

RIDGES BASIN DAM AND RESERVOIR PRE-CONSTRUCTION FACILITIES RELOCATIONS

PETROLEUM PRODUCTS SPILL ANALYSIS

APRIL 2002

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Analysis of the Potential for a Release of Petroleum Products

The proposed conversion of the Mid-America Pipeline Corporation (MAPCO) 10-inch-diameter natural gas liquids (NGL) pipeline to carry petroleum products has an associated inherent risk of a failure of the pipeline and the release of petroleum products to the environment. The Questar Environmental Impact Statement (EIS) reviewed these risks (BLM 2000). An additional analysis of localized risks to Ridges Basin and the project area surface water and groundwaters is presented below.

Environmental Consequences

To determine potential toxicity of a petroleum product spill, the most toxic component of the product is used. Benzene is considered the most toxic fraction of petroleum products because of the low concentration at which toxic effects occur. Benzene has low solubility in water, but is highly volatile. The majority of benzene spilled on water can be expected to float on the surface until it volatilizes and evaporates. Most benzene will volatilize and evaporate, and some will dissolve into the water. Benzene is used as the key indicator for toxicity of petroleum products because other fractions are less toxic. Benzene comprises about 2.2 percent of the volume of refined petroleum products (e.g., gasoline). Acute and chronic toxicity thresholds for rainbow trout exposed to benzene are 7.4 milligrams/liter (mg/L) and 1.4 mg/L, respectively (U. S. EPA 2000). Rainbow trout would probably be used as the principal fishery for Ridges Basin Reservoir and are the most effective indicator of toxicity to aquatic organisms for this project.

For a large spill (i.e., 1,815 barrels (bbls)), benzene is estimated to be acutely toxic at a water volume of up to about 0.70 acre-feet (af), and chronically toxic up to a water volume of 3.68 af (see table A-1). In the case of Ridges Basin Reservoir, the greatest risk of toxicity would occur within the first hour at a spread rate of 1,969 feet per hour (feet/hr). By the end of the first hour, following contact of the petroleum product with the water in the reservoir, the concentrations of benzene from a large spill (1,677 gallons (gals) would be about 0.002 mg/L; thereafter, the concentration of benzene would be less than 0.001 mg/L, which is far below toxicity levels (see table A-2).

Potential toxicity of materials in the pipelines to freshwater organisms (cladocera) is presented in table A-3. Acute toxicity of aromatic hydrocarbons to freshwater organisms is presented in table A-4. Toxicity of benzene to various organisms and freshwater biota are presented in tables A-5 and A-6. The information from these tables was used as a baseline for potential toxicity of materials escaping from the pipelines to human health standards and to the environment.

The worst possible case scenario for a petroleum leak or spill in Ridges Basin Reservoir would be during winter when low air temperatures would slow evaporation of petroleum product components, such as benzene; and with the reservoir at minimum allowable pool of 30,000 acre-feet. Under this scenario, toxicity levels of benzene during a large spill (1,677 gallons), would be the same as with the full pool volume of 120,000 af; i.e., 0.002 mg/L in the first hour and 0.004 mg/L thereafter. The lower volume of Ridges Basin Reservoir would still provide sufficient dilution to eliminate toxic effects of benzene. These spill scenarios assume little or no evaporation of benzene, and so the concentrations provided would be maximum.

Petroleum product residue (i.e., heavy hydrocarbons) could persist in the reservoir with uptake into the food chain. The concentration of residue in the reservoir is not expected to be high even with a large spill because of the relatively large fraction of evaporates and small fraction of residues. Conservation measures for rapid response and clean-up of spills or leaks would minimize the volume of material that could affect the environment.

The fraction of polycyclic aromatic hydrocarbons (PAHs), also known as polynuclear aromatic hydrocarbons (PNAs), is small in refined petroleum product. However, some residual of PAHs would be expected following a petroleum product spill. Polycyclic aromatic hydrocarbons are compounds associated with carcinogenesis (Lee and Grant 1981). Elevated levels of PAHs have been reported in the Animas River, but the source is unknown (Wilson et al. 1995). Levels of PAH compounds have also been found in the bile of most fishes from the San Juan River, indicating high current concentrations in that system.

Northern Route

Most of the northern route alternative, approximately 6.5 of the 6.9 miles, is located outside of the Ridges Basin drainage area. Much of the northern route traverses low ridges with minimal visibility from various locations around the Ridges Basin area.

Because the northern route traverses low ridges and is primarily outside of the Ridges Basin drainage area, a leak from an underground pipeline is likely to have a slower rate of spread through soil than a pipeline on a steep grade. Hence, although the northern route has a slightly greater risk associated with a pipeline leak, because of the greater length of pipeline, the risk of petroleum product reaching Ridges Basin Reservoir is not as great as the southern route because of the more gentle terrain associated with the northern route.

To minimize environmental consequences from a leak and spill of petroleum product, the section of the pipeline along the northern route that is in the Ridges Basin drainage should be treated as a stream crossing with appropriate block valves.

Southern Route

The southern route alternative is approximately 4.3 miles long, most of which is located within the Ridges Basin drainage area. Only about 0.3 mile, from MPs 1.0 to 1.3, is located outside of the drainage area. Most of the southern route is located on the steep face of Basin Mountain and is visible from various locations around the Ridges Basin area.

Because the southern route is located on steep slopes, the likelihood of a leak reaching Ridges Basin Reservoir is considered to be greater because of the steep gradient toward the reservoir. Released petroleum product would be expected to move more quickly, both below ground and above, if a leak occurred from a pipeline on the southern route.

To minimize environmental consequences from a leak and spill of petroleum product, Reclamation has committed to installing block valves at either end of the pipeline along the northern or southern routes as the routes enter and exit Ridges Basin.

TABLE A-1

Threshold Volume for Acute Toxicity for Alkanes (Hexane, Octane, Decane) and Acute and Chronic Toxicity for Benzene

	Large Spill (1,815 bbls)					**Threshold Volume for Toxicity**	
	Acute Toxicity (mg/L)	Flow Rate (bbls)	Flow Rate (gal)	2.2% (gal)	Toxicity Multiplier	gal	Af
Hexane	3.9	1,815	76,230	1,677	256.41	430,015	1.32
Octane	0.37	1,815	76,230	1,677	2,702.70	4,532,595	13.91
Decane	0.028	1,815	76,230	1,677	35,714.29	59,895,000	183.81
Benzene (acute)	7.4	1,815	76,230	1,677	135.14	226,630	0.70
Benzene (chronic)	1.4	1,815	76,230	1,677	714.29	1,197,900	3.68

	Detection Limit (67bbls)					**Threshold Volume for Toxicity**	
	Acute Toxicity	Flow Rate (bbls)	Flow Rate (gal)	2.2% (gal)	Toxicity Multiplier	gal	af
Hexane	3.9	67	2,814	62	256.41	15,874	0.05
Octane	0.37	67	2,814	62	2,702.70	167,319	0.51
Decane	0.028	67	2,814	62	35,714.29	2,211,000	6.79
Benzene (acute)	7.4	67	2,814	62	135.14	8,366	0.03
Benzene (chronic)	1.4	67	2,814	62	714.29	44,220	0.14

	Below Detection (744 bbls)					**Threshold Volume for Toxicity**	
	Acute Toxicity	Flow Rate (bbls)	Flow Rate (gal)	2.2% (gal)	Toxicity Multiplier	gal	af
Hexane	3.9	744	31,248	687	256.41	176,271	0.54
Octane	0.37	744	31,248	687	2,702.70	1,857,989	5.70
Decane	0.028	744	31,248	687	35,714.29	24,552,000	75.35
Benzene (acute)	7.4	744	31,248	687	135.14	92,899	0.29
Benzene (chronic)	1.4	744	31,248	687	714.29	491,040	1.51

Note - Toxicity for Hexane, Octane, and Decane is 48-H LC_{50} for Freshwater Cladocera, and Acute and Chronic Toxicity for Benzene is for Rainbow Trout.

TABLE A-2

Concentration of Benzene in Ridges Basin Reservoir for a Large Spill, Detection Limit Spill, and Below Detection Spill for Various Time Periods Leading to Complete Dispersal Throughout the Reservoir

Time from Initial Contact with Water (hours)	Spread Rate of 600 M/H (1,969 Feet/hr) Radius (feet)	Volume (af)	Large Spill (1,815 bbls) Benzene Concentration (1,677 gal)	Detection Limit (67 bbls) Benzene Concentration (62 gal)	Below Detection (744 bbls) Benzene Concentration (687 gal)
1	1,969	2,516	0.002032929	7.56099E-05	0.000838
4	7,874	55,894	9.15283^{E}-05	3.40417E-06	3.77E-05
4.5	9,000	58,418	8.75732^{E}-05	3.25707E-06	3.61E-05
8	15,749	116,274	4.39984^{E}-05	1.63641E-06	1.81E-05
8.51	17,010	120,000	4.25993^{E}-05	1.58438E-06	1.76E-05

Note - Maximum Reservoir Width is 9,000 Feet and Maximum Length is 17,010 Feet at Full Capacity of 120,000 af

TABLE A-3

Acute Toxicity of Petroleum Hydrocarbons to the Freshwater Cladocera, *Daphnia Magna*

Compound	48-hr LC_{50} (mg/L)[a]	Optimum	Relative Toxicity
Alkanes			
Hexane	3.9	9.5	2.4
Octane	037	0.66	1.8
Decane	0.028	0.052	1.9
Cycloalkanes			
Cyclohexane	3.8	55.0	145
methyl cyclohexane	1.5	14	9.3
Monoaromatics			
Benzene	9.2	1,800	195.6
Toluene	11.5	515	44.8
Ethylbenzene	2.1	152	72.4
p-xylene	8.5	185	21.8
m-xylene	9.6	162	16.9
o-xylene	3.2	175	54.7
1,2,4-trimethylbenzene	3.6	57	15.8
1,3,5-trimethylbenzene	6	97	16.2
Cumene	0.6	50	83.3
1,2,4,5-tetramethylbenzene	0.47	3.5	7.4
Polyaromatics			
1-methylnaphthalene	1.4	28	20.2
2-methylnaphthalene	1.8	32	17.8
Biphenyl	3.1	21	6.8
Phenanthrene	1.2	6.6	5.5
Anthracene	3.0	5.9	2.0
9-methylanthracene	0.44	0.88	2.0
Pyrene	1.8	2.8	1.6

Source: Neff (1979), Lawrence and Weber (1984), West et al. (1984), Couch and Harshbarger (1985)

Note: LC_{50} is the concentration of a compound necessary to cause mortality in 50 percent of the laboratory test organisms within a predetermined time period (e.g., 48 hours).

TABLE A-4

Acute Toxicity of Aromatic Hydrocarbons to Freshwater Organisms

Species	Toxicity Values (LC_{50} and EC_{50} in mg/L)				
	Benzene	Toluene	Xylene	Naphthalene	Anthracene
Fish					
Carp (*Cyprinus carpio*)	---	---	780	---	---
channel catfish (*Ictalurus*)	---	240	---	---	---
clarias catfish (*Clarias* sp.)	---	26	---	---	---
Coho salmon (*Oncorhyncus*) *kisutch*)	---	---	---	2.6	---
fathead minnow (*Pimephales*)	---	36	25	4.9	25
Goldfish (*Carassius auratus*)	---	23	24	---	---
guppy (*Poecilia reticulata*)	---	41	---	---	---
largemouth bass (*Micropterus*	---	---	---	0.59	---
Medaka (*Oryzias* sp.)	---	54	---	---	---
mosquitofish (*Gambusia affinis*)	---	1,200	---	150	---
rainbow trout (*Oncorhyncus*) *mykis*)	7.4	8.9	8.2	3.4	---
zebrafish (*Therapon jarbua*)	---	25	2.0	---	---
Invertebrates					
Rotifer (*Brachionus calyciflorus*)	---	110	250	---	---
midge (*Chironomus attenuatus*)	---	---	---	15	---
midge (*Chironomus tentans*)	---	---	---	2.8	---
cladocera (*Daphnia magna*)	30	41	---	6.3	0.43
cladocera (*Daphnia pulex*)	---	---	---	9.2	---
zooplankton (*Diaptomus forbesi*)	---	450	100	68	---
amphipod (*Gammarus lacustris*)	---	---	0.35	---	---
amphipod (*Gammarus minus*)	---	---	---	3.9	---
snail (*Physa gyrina*)	---	---	---	5.0	---
insect (*Somatochloa cingulata*)	---	---	---	1.0	---
Algae			---		---
Chlorella vulgaris	---	230	---	25	---
Microcystis aeruginosa	---	---	---	0.85	---
Nitzschia palea	---	---	---	2.8	---
Scenedesmus subspicatus	---	130	---	---	---
Selenastrum capricornutum	70	25	72	7.5	---

Source: EPA AQUIRE Database (1998)

Note - Data Summarize Conventional Acute Toxicity Endpoints (LC_{50} and EC_{50}); Geometric Mean is Reported when Several Results were Available for a Given Species

TABLE A-5

Toxicity of Benzene to Various Organisms

Taxa	Toxicity Values (mg/L)
Aquatic species	7.4
terrestrial plants	18.2
Earthworms	>1,000 mg/kg

Source: U.S. Environmental Protection Agency ECOTOX Database (2001)

TABLE A-6

Acute Toxicity of Benzene to Freshwater Biota

Taxa	Test Species	Chronic Value (mg/L)	Test Endpoint
Fish	fathead minnow (*Pimephales promelas*)	17.2	growth
	guppy (*Poecilia reticulata*)	63	mortality
	coho salmon (*Oncorhynchus kisutch*)	1.4	mortality
Amphibian	leopard frog (*Rana pipens*)	3.7	mortality
		3.5	mortality
Invertebrates	Zooplankton (*Daphnia* spp.)	>98	mortality
Algae	green algae (*Selenastrum capricornutum*)	41	mortality
		4.8	growth
		3.9 - 4.4	growth

Source: EPA ECOTOX Database (2001)

Drinking Water Standards

For human health protection, the Maximum Contaminant Level (MCL) is an enforceable standard established by the EPA and designed to protect long-term human health. As with potential toxicity to the environment, benzene is used as the most sensitive indicator because it has the lowest MCL at 0.005 mg/L.

It is assumed that because benzene constitutes 2.2 percent of the petroleum product, it is assumed that benzene would constitute 2.2 percent of the released volume. Some benzene is expected to evaporate upon release, and use of a 2.2 percent fraction is considered a reasonable maximum concentration.

Based on total calculated benzene concentrations at large spill, detection limit, and below detection scenarios, a concentration exceeding water quality standards of 0.005 mg/L would not be expected except very locally shortly after the petroleum product contacts the water in the reservoir.

Pipeline Safety

The transportation of petroleum products always has inherent risk. According to the Association of Pipe Lines (AOPL), 57 percent of petroleum products in the United States are transported by pipelines, 38 percent by water carriers, 3 percent by motor carriers (e.g., tanker trucks), and 2 percent by railroads. Every year, over 12 billion bbls of petroleum and petroleum products are transported by interstate pipelines.

Pipelines are considered to be the safest and cheapest mode of transportation for petroleum and petroleum products. AOPL reports that trucking of petroleum is 87 times more likely to result in human fatalities than by pipeline. Trucking also results in fires and/or explosions about 35 times more frequently than for pipelines transporting petroleum. However, maximum volumes from trucks are finite and smaller.

Transportation of petroleum products by pipeline is also cost-effective. A moderate-size pipeline that transports 150,000 bbls per day (bpd) would require 750 tanker trucks or a railroad train of 75 tank cars per day. The cost of transporting a barrel of petroleum products from Houston to New York via pipeline is about $1, which is considerably less than other modes of transportation.

Inherent risks and hazards are associated with transporting petroleum products by pipeline. The risks and hazards are a function of the probability of an accidental release of petroleum product to the environment. Significant human risk can occur with products released into water used for domestic and industrial uses, and significant environmental damage can occur from releases into wetlands or sensitive or aquatic ecosystems.

U. S. Department of Transportation (DOT) accident data indicate that the number of accidents for petroleum product pipelines was similar to other hazardous liquid pipelines, and the number of accidents was stable over the past 15 years. Between 1986 and 2000, an average of 88 accidents per year occurred along petroleum product pipelines throughout the United States. Based on DOT data from 1986 to 1999, the probability of a spill event of 50 bbls or more is 1.3 releases per 1,000 miles per year; 1.1 injuries per 10,000 miles per year; and 1.6 fatalities per 100,000 miles per year. In California, pipeline release data show a release probability of 2.9 releases per 1,000 miles per year, including releases of less than 50 bbls. DOT accident data report that spills of less than 50 bbls occurred most frequently, and the majority of spills were 150 bbls or less. A spill of 150 bbls is approximately the same volume as a tanker truck that typically carries 180 bbls. Fewer than 4 percent of hazardous liquid spills released more than 5,000 bbls of petroleum product to the environment.

Petroleum products are flammable and corrosive products that are obtained from distilling and processing of crude oil, unfinished oils, NGLs, blend stocks, and other miscellaneous hydrocarbon compounds. The National Transportation Safety Board (NTSB) defines petroleum products as diesel fuel, fuel oil, gasoline, gasoline and fuel oil mixtures, jet fuel, kerosene, oil and gasoline mixtures, turbine fuel, toluene, xylene, and benzene. This definition does not include crude oil, condensate, natural gasoline, and liquefied petroleum gas (LPG). Highly volatile liquids, such as natural gas liquids, LPG, ethylene, and anhydrous ammonia, are not considered with petroleum products because these products form vapor clouds upon release that pose uniquely different risks to public safety and the environment. The NTSB list of petroleum products is similar to the products proposed for transport through the Williams pipeline.
DOT data for 1985 to 2000 show the probability of fire or explosion from petroleum product related incidents. Fires and explosions occurred in 7.5 and 1.9 of the reportable incidents on petroleum product

pipelines, respectively. The probability of fire associated with a petroleum product pipeline is 6.3 fires per 10,000 miles per year, and the probability of an explosion is 1.6 explosions per 10,000 miles per year.

Regulatory Framework

Pipeline safety regulations related to design, construction, operation, maintenance, and emergency and spill response currently protect all environmentally sensitive areas, cultural resources, and economically valued resources. The National Environmental Policy Act (NEPA) and this Environmental Report require full disclosure of all actions that may affect environmental and human quality. In the event of a spill, several federal regulatory programs define the notification requirement and process required, including the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 CFR Par 300), the Clean Water Act, the Oil Pollution Act, and the Superfund Amendment and Reauthorization Act. These programs require notification and initiation of response actions in a timeframe and on a scale commensurate with the threat. These programs also establish and mandate an endpoint for response actions, including mitigation and unacceptable threat. Releases on public lands, including tribal reservations, are subject to Natural Resource Damage Assessments under the authority of the Oil Pollution Act, which provides a mechanism for financial compensation for short- and long-term damages to natural resources and for restoration costs.

Probability of Spills

If MAPCO's 10-inch-diameter pipeline is converted to carry the petroleum products, including refined gasoline, the toxicity potential would change. Potential toxicity of these materials is assessed on the basis of three probable release scenarios should be: (1) active leak detection lower limit of 1 percent of pipeline flow (i.e., about 32 barrels per hour (bph)); (2) complete rupture and maximum release of 3,200 bph; and (3) small leak rate of 1 bph (see table A-7).

For the first scenario, the active leak detection lower limit of 32 bph would be expected to be detected within 30 minutes. An additional 30 minutes would be required to confirm the leak and close remotely activated block valves to isolate the affected segment. Within a time of 1 hour, approximately 32 bbls of product would be released. Assuming a drain down volume of 5 percent (i.e., 35 bbls) prior to repair, a total release of 67 bbls of product would be expected.

The second spill scenario involves a complete rupture of the pipeline, which the leak detection monitoring system would be expected to isolate in 30 minutes. At a maximum release rate of 3,200 bph, approximately 1,600 bbls would be released within the first 30 minutes prior to block valve closure. Because petroleum products would be retained in the isolated pipe segment, product would continue to leak through the rupture until repaired. Based on an assumed draw down volume of 28 percent (i.e., 215 bbls), a total of 1,815 bbls of product would be released.

Under the third scenario, a small leak of 1 bph would not be detected by the active leak detection monitoring system, and would have to be detected by a static test. Detection limit of a static test is 1 bph. If the leak occurred immediately after a static test, the leak would not be detected until the following test, about one month apart. Hence, a total of 744 bbls of product would be released in 31 days (1 bph x 24 hours/day x 31 days). No drain down would occur under this scenario because the amount of product leaking from the pinhole would be minimal once the leak was detected, the pipeline depressurized, and the leak repaired.

TABLE A-7

Estimates of Projected Spill Release Volumes Based on Three Leak Scenarios

Pipeline Project (2001)

Leak Rate	Leak At Detection Limit Scenario 32 bph (1,344 Gallons Per Hour)		Large Rupture Scenario 3,200 bph (134,400 Gallons Per Hour)		Leak Below Detection Limit Scenario 1 bph (42 Gallons Per Hour)	
	Time (Minutes)	Spill Volume (bbls)	Time (Minutes)	Spill Volume (bbls)	Time	Spill Volume (bbls)
Time required to detect and close valves	60	32 (1,344 gals)	30	1,600 (67,200 gals)	Assume 31 days before detection	744 (31,248 gals)
Drain down volumes after valve closure	N/A	35 (5% drain down	N/A	215 (28% drain down)	N/A	0 (No drain down)
Total Spill Volume	N/A	67 (2,814 gals)	N/A	1,815 (76,230 gals)	N/A	744 (31,248 gals)

Source: Environmental Impact Statement: Questar, Williams, & Kern River

Because the pipelines are buried throughout their entire lengths along either the southern or northern routes, any release of material would first contact surrounding soils before being released into the environment. Retention time in soils would depend on soil porosity and slope. Petroleum products would travel at a faster rate once the material reaches the surface of the ground. The greatest potential for transport of toxic materials is via groundwater or surface water contact. The likelihood of spilled materials entering groundwater is not considered high because most groundwater in the project area is 50 feet deep or deeper, and groundwater wells are located some distance from the pipeline.

Once spilled material reaches the ground surface, the greatest potential for toxicity is to Ridges Basin Reservoir. At spread rates of 100 meters per hour (m/h) (328 feet/hr) for heavy crude oil, 300 m/h (984 feet/hr) for light crude, and 600 m/h (1,969 feet/hr) for refined petroleum, the time required for a spill to spread throughout the reservoir is dependent on weight and viscosity. Table A-8 provides the radius of a spill, based on the three spread rates. At 120,000 af (full capacity), Ridges Basin Reservoir would be approximately 9,000 feet at its widest point, and 17,010 feet at its longest point. At a spread rate of 1,969 feet/hr, refined petroleum would spread across the reservoir (9,000 feet) in approximately 4.5 hours, and would spread the entire length of the reservoir (17,010 feet) in approximately 8.5 hours. At a slower spread rate of 984 feet/hr, refined petroleum would spread across the reservoir (9,000 feet) in approximately 9 hours, and would spread the entire length of the reservoir (17,010 feet) in approximately 17 hours. Product carried in the 10-inch-diameter pipeline would be gasoline, if the decision is made to reverse flow and change the product in the line. Gasoline is a refined petroleum product and would be expected to spread at the faster rate of about 1,969 feet/hr, characterized by the third scenario described above.

Volume of water affected by the different spread rates is also summarized in table A-8. Volume of water affected is based on the expected spread rate radius (r) from a shoreline (0.5 area of a circle), calculated as square feet of surface area ($0.5 \times \pi r^2$) times average depth at the radial distance from shore. At the fastest spread rate of 1,969 feet/hr, the volume of water affected in the first hour after the petroleum product contacts the water is approximately 2,516 af. It is assumed that once the product spreads across the entire reservoir, the entire volume of the reservoir is affected [i.e., at a spread rate of 1,969 feet/hr, the entire reservoir (120,000 af) would be affected in approximately 8.51 hours.] Calculation of volume of water affected over time allows for determination of potential toxicity from the more hazardous components of the petroleum product.

TABLE A-8

Radius of Water Surface and Volume of Water Affected by Petroleum Products at Three Different Spread Rates of 100 m/h (328 feet/hr), 300 m/h (984 feet/hr), and 600 m/h (1,969 feet/hr)

Time from Initial Contact with water (hr)	Spread Rate of 100 m/hr (328 feet/hr)		Spread Rate of 300 m/hr (984 feet/hr)		Spread Rate of 600 m/hr (1,969 feet/hr)	
	Radius (feet)	Volume (af)	Radius (feet)	Volume (af)	Radius (feet)	Volume (af)
1	328	39	984	594	1,969	2,516
4	1,312	1,241	3,937	16,768	7,874	55,894
4.5	1,476	3,247	4,429		9,000	58,418
8	2,625	6,212	7,874	55,894	15,749	116,274
8.51	2,792	7,259	8,376		17,010	120,000
9	2,953		9,000	58,418	---	---
12	3,937	16,768	11,812	90,563	---	---
17.01	5,581		17,010	120,000	---	---
24	7,874	55,894	---		---	---
27	9,000	58,418	---		---	---
48	15,749	116,272	---		---	---
51.03	17,010	120,000	---		---	---

Note: Maximum Width of Ridges Basin Reservoir is 9,000 feet and maximum length is 17,010 feet at full capacity of 120,000 af.

The proposed southern route for the pipeline relocation is approximately 4.3 miles long, and the proposed northern route alternative is approximately 6.9 miles long. The probability of spills for each of these alternatives is presented in table A-9.

Based on DOT average probability data for 1986 to 1999, the probability of a release, injury, or fatality from a single pipeline along the southern route (4.3 miles) is once in 179; 2,114; or 14,535 years, respectively. The probability of a release, injury, or fatality from the four pipelines combined along the southern route is once in 45; 529; or 3,634 years, respectively. The probability of a release, injury, or fatality from a single pipeline along the northern route (6.9 miles) is once in 111; 1,318; or 9,058 years, respectively. The probability of a release, injury, or fatality from the four pipelines combined along the northern route is once in 28; 132; or 2,264 years, respectively. Based on the 50-year service life of the pipelines, only one release would be expected to occur in either the southern route (once in 45 years) or the northern route (once in 28 years), and no injuries or fatalities would be expected. The probability is that the one spill would be 50 bbls or less in volume.

TABLE A-9

Probability of Spills from the Petroleum Product Pipelines Relocated in Ridges Basin, Based on DOT Average Probability Data for 1986 to 1999

Pipeline	Length of Relocation (miles)	Probability (per mile*year)			Probability (per mile*year)		
		Release	Injury	Fatality	Release	Injury	Fatality
Southern Route	4.3	0.0013	0.00011	0.000016	0.00559 (179 yr)	0.000473 (2,114 yr)	0.0000688 (14,535 yr)
Northern Route	6.9	0.0013	0.00011	0.000016	0.00897 (111 yr)	0.000759 (1,318 yr)	0.0001104 (9,058 yr)
Southern Route (three pipelines cumulative)					0.02236 (45 yr)	0.001892 (529 yr)	0.0002752 (3,634 yr)
Northern Route (three pipelines cumulative)					0.03588 (28 yr)	0.007568 (132 yr)	0.0004416 (2,264 yr)

Note: Probabilities are presented for three pipelines in each, the southern and northern route alternatives. Number of years between expected incidents is provided under probabilities.

Another way to express the risk associated with an accidental release is based on probability of release for a given mile of pipeline. The estimated occurrence interval for a spill of 150 bbls or less for a given mile of pipeline is 665 years, while a major spill of more than 1,000 bbls is once every 1,947 years. Hence, the risk of a spill of 150 bbls or less for a given mile of pipeline is a 1 in 13 chance over the service life of the project (i.e., 50 years), and the risk of a spill greater than 1,000 bbls is a 1 in 39 chance. For the 4.3 miles of the southern route, the risk of a spill of 150 bbls or less is every 155 years or a 1 in 3 chance over the service life of the project; the risk of a spill greater than 1,000 bbls is every 453 years or a 1 in 9 chance. For the 6.9 miles of the northern route, the risk of a spill of 150 bbls or less is every 96 years or a 1 in 2 chance over the service life of the project; the risk of a spill greater than 1,000 bbls is every 282 years or a 1 in 6 chance.

Safety Measures

Appropriate planning and identification of potential safety problems are paramount to proper construction and operation of petroleum product pipelines. In addition to the regulatory framework identified above, safety measures must be incorporated into emergency and spill response protocols. These protocols are provided in detail in safety response plans that are periodically updated. Any necessary equipment vital to full performance of these plans must be kept available and in proper working order. Accidental releases of petroleum products are never planned, and appropriate agencies and staff must remain aware of protocols at all times when responding to emergencies.

Pipeline Break and Leakage

Northwest and MAPCO propose to minimize the potential impact of a pipeline break by implementing mitigation measures as specified in the June 2001, Final Environmental Impact Statement Questar, Williams, & Kern River Pipeline Project. These include visual surveillance and operator diligence, as well as pipeline isolating and shut-off valves. In addition, three technology-based leak detection systems would be implemented to facilitate the early detection of pipeline leaks. These systems include:

- Leak detection software associated with the Supervisory Control and Data Acquisition (SCADA) monitoring system

- Shut-in (static) tests to detect small leaks in steep terrain
- Volumetric Balancing

The SCADA and leak detection system would monitor pipeline operation from a centralized location to quickly detect abnormal operation, including a pipeline leak. The SCADA system would be used for data collection and remote pipeline operations, such as remote closure of motorized valves.

An Emergency Response Plan for operations would be developed that details measures to contain spills and prevent further dispersal. This plan would require a response team on-site within 1 hour of leak detection. This plan would include the establishment and maintenance of on-site equipment and materials needed for hazardous spills clean-up. The plan would also describe measures and actions that would be taken to minimize, as much as possible, adverse effects of a hazardous materials spill to the environment. The plan would include provisions for portable baffles or booms to be used on land and in the reservoir to contain and impede the spread of a spill. Activities to clean a spill and repair a pipeline could disturb eagles in the area of the reservoir. Appropriate measures would be taken to minimize this disturbance.

The proposed Northwest 26-inch-diameter natural gas pipeline facilities would be designed, constructed, operated, and maintained in accordance with DOT Minimum Federal Safety Standards specified in 49 CFR Part 192 – Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards. The Part 192 defines and specifies:

- Material selection and qualification;
- Minimum design requirements;
- Protection for internal, external, and atmospheric corrosion; and
- Area classifications, based on population density. More stringent safety considerations are required in more populated areas.

The safety standards specified in Part 192 require each pipeline operator to:

- Develop an emergency plan, working with local fire departments and other agencies to identify personnel to be contacted, equipment to be mobilized, and procedures to be followed to respond to a hazardous condition caused by the pipeline;
- Establish and maintain a liaison with the appropriate fire, police, and public officials in order to coordinate mutual assistance
- Establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a natural gas or petroleum products pipeline emergency and report it to appropriate public officials.

The new MAPCO 10-inch and 16-inch-diameter pipelines would be designed, constructed, operated, and maintained in accordance with DOT regulations in 49 CFR Part 195, "Transportation of Hazardous Liquids by Pipeline."

These regulations for the safe construction, operation, and maintenance of the natural gas and NGL pipelines in Ridges Basin would be complied with. There is an emergency plan for handling emergency conditions at pipeline facilities which provides for the safety of the general public and of individuals at the emergency site. It includes procedures for notifying the appropriate public officials when a gas pipeline emergency has occurred and coordinating with these officials regarding planned responses and actual responses during an emergency. The proximity of the proposed project to the city of Durango would enhance the speed and response time of emergency services in the event of an emergency situation.

There also is a successful quality assurance and quality control program and engineering standards that encompass material specifications, pipe and component design, and proper procedures for welding, construction, and testing. These standards meet or exceed the requirements set forth in Parts 192 and 195. In addition, Northwest and MAPCO 's standards incorporate by reference all of the applicable standards published by industry, government, and professional engineers.