ng1\_ PF12-9

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 **PF12-9**

Comments on the Scope of the Federal Energy Regulatory Commission (FERC) Environmental Impact Statement (EIS) for the proposed Constitution Pipeline

***IN THE ANSWERS TO ALL QUESTIONS PLEASE PROVIDE THE FORMULA OR MODEL USED AND THE ATTENDANT MATHEMATICS SO THAT THE PUBLIC CAN UNDERST AND CRITIQUE THE RESULTS.***

***THIS WILL BE NO LESS THAN A PEER REVIEW OF THE INFORMATION PROVIDED.***

***THIS GIVES THE WORLD COMMUNITY THE OPPORTUNITY TO JUDGE THE OPENNESS AND COMPETENCE OF FERC AND THE U.S. GOVERNMENT TO ITS CITIZENS.***

***IF YOU HAVE ANY QUESTIONS CONCERNING MY QUESTIONS, HYPOTHESES, OR FACTS, PLEASE CONTACT ME.***

 ***THIS PROCESS SHOULD BE A DIALOGUE BETWEEN THE PUBLIC SERVANTS AND THE CITIZENRY.***

Abstract:

This is an analysis of the documents produced by scientists and government agencies, and documents made available in the public “open houses” by Williams and FERC, to understand the impact of the Constitution Pipeline (CP) on the environment, and on the citizens of affected towns, counties and states.

The document NTSB/Par-03/01 was useful in the understanding of why the El Paso natural gas pipeline in Carlsbad, New Mexico failed and the extent of the damages. I was able to draw conclusions from that and derive the Minimum Kill Zone (MKZ) and apply it to the proposed Constitution Pipeline. By using Forensic Seismology and the CP MKZ, I was able to come up with the potential disaster facing the Town of Worcester, NY, and then apply that to all the proposed routes of the CP.

Areas of Inquiry:

1. Pre-Disaster: Asks FERC to calculate the impact of the knowledge of the CP MKZ on the psychological health of the citizens, and the economic impact along all of the proposed routes.
2. Post-Disaster: Describes what would be destroyed by a pipeline explosion in the Town of Worcester, NY, and asks FERC questions of physics of pipeline explosions with different starting scenarios, the economic impacts, the assets needed and cost in preparing for inevitable disasters, and the projected psychological impacts and the costs incurred by such a disaster by using the data from disaster of The World Trade Center 9-11-2001 (9/11).
3. One of FERC’s concerns is the impact to the environment. Not only does the CP route “M” travel through the watershed of Worcester, NY, but for most of its length it is located in a major watershed. How would a disaster at any part of its length impact those who are down- gradient?
4. Geological faults in the primary route (the blue line on Williams maps) and alternative route M (the red line on the map). Both routes run parallel to major seismic faults and minor faults and are also crossed by major and minor faults. This alone precludes building this pipeline as it is impossible to know the interactions of these faults and to prepare for all the possibilities of disaster.
5. Pipeline inspections do not eliminate disasters. The only way to prepare for disaster is to understand the possibilities for disaster; and if the possibilities cannot be totally eliminated then build the CP pipeline where other pipelines exist, as that does not increase the risk to new populations and environments.
6. Pipeline safety is left to private firms that are not under the control of the U.S. Government, and private companies have put off government- mandated inspections and repairs. This has been shown in accident after accident.

 VII. Conclusion.

**We cannot allow dangerous projects to be built in dangerous areas and hope that humans have the will, ability, and integrity to prevent them. There is a history of human behavior causing accidents to happen regardless of whether the dangers were unknown, ignored or because prescribed procedures were not followed. Because of the overwhelming evidence presented, FERC, in the planning stage of this project, must recognize existing hazards that cannot be mitigated, and the history of accidents, and must deny both the proposed primary route and the alternative route “M” for the Constitution Pipeline.**

**Exhibit A.**

The following quotes were from the PIPELINE ACCIDENT REPORT

Natural Gas Pipeline Rupture and Fire Near Carlsbad, New Mexico August 19, 2000. NTSB/PAR--03/01, PB 2003-916501

Factual Information:

Pg. 4. Aerial view of accident site looking east.

Pg. 6. Figure 5. Post-rupture fire. Photograph of flame. “At lower left of the fire ball can be seen the 85-foot tall support structures for the pipeline suspension bridges.”

Pg. 9. “The victims were camped about 675 feet from the crater, between the crater and the river.”

Pg. 10. “The force of the ruptures and the violent ignition of the escaping gas created a 51-foot-wide crater about 113 feet along the pipe. A 49- foot section of the pipe was ejected from the crater in three pieces measuring approximately 3 feet, 20 feet, and 26 feet in length…. The largest piece was found about 287 feet northwest of the crater in the direction of the suspension bridges.”

Pg. 11. Figure 6. (El Paso Crater DOC001.pdf) “Looking west at a portion of the crater created by the rupture. The missing sections of the pipe between the arrows was ejected from the crater.”

Pg. 11. INJURIES

 “All 12 persons who were camping on the east bank of the Pecos River were fatally injured in the accident. The causes of death were extensive thermal burns, carbon monoxide poisoning, and smoke inhalation.”

Pg.12. DAMAGES –

 “Approximately 49 feet of the underground portion of the line 1103 were ejected in three pieces from the crater created by the rupture. Two of the pieces of pipe were thrown 234 and 287 feet, respectively,…One of these pieces hit the cables that supported the pipeline suspension bridges across the river. The concrete anchor blocks for the cables, the cables themselves, and the two suspension bridge steel structures on the east side of the river were burned, as were the aboveground portions of the pipelines. The two pipelines that were being supported on the bridges…fell and came to rest on the ground on each side of the river, but neither leaked…The three vehicles and the camping equipment on the east side of the river were destroyed, and vegetation along both riverbanks was burned. Based on the photographs taken of the fire as it engulfed the suspension bridges, the height of the flame was calculated to be about 496 feet.”

Pg. 13. Metallurgical Examination

“On-site examination of the three pieces of the pipe that were ejected from the crater at the rupture site identified sever[*sic*: severe] internal corrosion along the interior bottom of the pipe.…no evidence of corrosion on the outside of the pipe or the internal surface across the top half of the pipe… Sever[*sic*: Severe] wall loss due to corrosion was observed on the inside of the pipe at the bottom…the most severely corroded area reduced the original pipe wall thickness by 72 percent,…”

Pg. 16 “ The pipeline was operating at approximately 675 pounds per square inch gauge (psig) , at the time of the accident.”

Pg. 18. Pigging Operations

“According to EPNG [El Paso Natural Gas], when possible, cleaning pigs were run a minimum of twice per year.”

Pg. 21. Test and Inspections

“The line 1103 the right –of –way had most recently (before the accident) been inspected on August 11, 2000, by aerial patrol and on August 18, 2000 by ground patrol. Inspectors looked for evidence of leaks (such as discolored soil or dying vegetation), erosion, and excavation near the pipeline. No leaks were reported.”

**Exhibit B.**

“Large crater created by gas pipeline explosion, August 19, 2000, Eddy County, New Mexico (the State Police GPS location is (32.03785,-104.0286). The crater is 86 feet long, 46 feet wide, and 20 feet deep. The people camped near the pipeline may have been unaware of its exact location because it was buried 15 feet underground, although the pipeline emerged from the ground to cross the Pecos river at a nearby bridge.” Source: <http://www.ees.nmt.edu/Geop/Pipeline/pipeline.html>; accessed November 9, 2008.

Analysis by Clark Rhoades from the Pipeline Accident Report:

Pg. 4 . Figure 4. Aerial view of accident site looking east.

Pg. 9. “The victims were camped about 675 feet from the crater, between the crater and the river.”

Pg. 11. INJURIES “All 12 persons who were camping on the east bank of the Pecos River were fatally injured in the accident. The causes of death were extensive thermal burns, carbon monoxide poisoning, and smoke inhalation.”

Pg. 16 “ The pipeline was operating at approximately 675 pounds per square inch gauge (psig) , at the time of the accident.”

**Exhibit C.** (ng-El Paso Air Photo DOC000.pdf) From Pg.4, Figure 4. I have plotted the distance from the center of the fire to the center of the three vehicles arranged in a circle, in the aerial photograph, which is 675 from the center of the crater in the photograph. Using that as a known distance I then plotted the distance to the bottom left of the photograph which shows trees on the other side of the river that are burnt and without leaves, which is 2025 feet. The other side of the river may have been burnt at a further distance but I am limiting the burn distance to only what is available in the photo. Prior to the pipeline explosion the river provided water for the trees that had green leaves and shrubs along and near its bank. The fire’s infrared radiation (IR) caused the leaves to dry out and then catch fire. Any fire with the IR intensity that will cause green leaves to burn will certainly cause fatal third degree burns to humans. The total amount of natural gas came from the two severed ends of the 30-inch diameter pipeline; this would be case in any break of any compressed gas pipeline. I will call the 2025 feet the “Minimum Kill Zone” or (MKZ) of the El Paso Pipeline.

With the maximum allowable pressure of 1450 psi of the Constitution Pipeline (CP), which is also a 30-inch diameter pipe, I can draw the conclusion by using algebra that the MKZ of the Constitution Pipeline (CP) will be 4350 feet.

**Exhibit D. (ng-route M mile 50.pdf) Is a copy of the map of the alternative route M with the red line showing the exact location of the pipe at close to Mile 50 of the M pipeline alternative, Otsego County Highway 39, and the underpass of I-88.**

**Exhibit E. (ng-CP MKZ for Worcester NY 001.pdf) Is the tax map of Town of Worcester.**

I have marked out the distances in a few places in **Exhibit E.** You will see that the MKZ of the CP would wipe out all of the center of the Town of Worcester, NY, including but not limited to:

The Town Hall

The Worcester Fire House

Three churches

The Theater

Citizens Bank

A hardware store

An Insurance agency

A real-estate company

The office of Cash Oil Co.

The Worcester Inn

The Worcester food market

A pizza restaurant

An auto dealership

A commercial garage

Two gas stations

The Worcester town garage

A US Post Office

The Worcester Library

Worcester Emergency Service

The Worcester Town Hall

All of the designated “safe zone for children”

The Worcester Central School

The school has over 400 students and at times there are approximately 50 adults on the school grounds or near the school. Because a pipeline explosion would cause the destruction of the Worcester Fire House, The Worcester Emergency Service, and burning buildings, there would be no way to save the children and adults in the school.

Part of I-88 and underpass of County Rt. 39 would be damaged. Some of the vehicles on I-88 and State Rt. 7 could be consumed in the MKZ and traffic would be halted. The routes entering Worcester would be temporally unusable by emergency vehicles.

Similarly if the pipeline exploded opposite the hamlet of East Worcester, much of it would also be destroyed.

Areas of Inquiry:

1. **Pre-Disaster**
2. Calculate the effects on the Town of Worcester citizens of the knowledge of the possibility of such a disaster with the MKZ 4350 feet.
3. Psychological trauma to children and adults.
4. Insurance premiums.
5. Property values.

1. Calculate the effects to all the people in all of the towns, counties, and states where all the proposed routes are situated with the public knowledge of the CP MKZ of 4340 feet.
2. Psychological trauma to children and adults.
3. Insurance premiums.
4. Property values.
5. **Post-Disaster in Worcester, NY**

1. If the Town of Worcester was destroyed, the knowledge of the MKZ would have wide psychological and economic effect. Using an economic model, calculate the loss of land value, loss of tourism, the cost for psychological counseling, the loss of productivity of adults, the psychological impact on children, parents, and relatives in the counties on which all the proposed routes that the pipeline passes through in separate time periods. A model that could be used is the destruction of the World Trade Center:

a. One week.

b. One month.

c. One year.

d. Two years.

 e. Five years.

B.

1. Provide the number of buildings on either side of the primary line (the blue line on the map), of the full length of the proposed CP that are within the CP MKZ 4350 feet.
2. Document the purpose of each building, in question 1, i.e. school, business, residence, government building, energy facility, energy transmission structures (electrical, gas, propane, etc.), substation, compressor, control buildings, etc.
3. Provide the names of owners and physical address of each place identified in question 2,including full contact information, parcel identifying number, including state, county, and town.

4. Provide the number of buildings on either side of the full length of route M, (the red line on the map), that are within 4350 feet of the pipeline.

1. Document the purpose of each building in question 4, i.e. school, business, residence, government building, energy facility, energy transmission supplies (electrical, gas, propane, etc.), substation, compressor, control buildings, etc.
2. Provide the names of owners, physical address of each place identified in question 5, full contact information, parcel identifying number, including state, county, and town.

**Exhibit F.**

“The large crater created by gas pipeline explosion, August 19, 2000, Eddy County, New Mexico (the State Police GPS location is (32.03785,-104.0286). The crater is …20 feet deep. The people camped near the pipeline may have been unaware of its exact location because it was buried 15 feet underground, although the pipeline emerged from the ground to cross the Pecos River at a nearby bridge.” Source: <http://www.ees.nmt.edu/Geop/Pipeline/pipeline.html>; accessed November 9, 2008

D. From (Exhibit A.) Pg. 10. “The force of the ruptures and the violent ignition of the escaping gas created a 51-foot-wide crater about 113 feet along the pipe. “ and (EXHIGIT F) “20 feet deep” Answer the following questions providing the formula and mathematics used to describe your answers: ***All questions are based on a 30 inch diameter pipe that have the two end’s of the pipeline discharging gas, as in the Carlsbad fire and operating at 1450 psi.***

1. Calculate the dimensions of the depression after rupture but before ignition at:
2. 4 feet
3. 15 feet

2. Calculate the diameter of a gas flame 30 seconds after ignition when the flame had stabilized, if the pressure was 1450 psi, both broken ends emitting gas and buried at 4 feet:

 a. 100 feet high.

b. 200 feet high.

c. 400 feet high.

d. 600 feet high.

e. 800 feet high.

3. Calculate the infrared (IR) signatures of a flame calculated in question 2. in watts per square meter over the entire combined IR spectrum at ground level at the following distances:

 a. 500 feet,

 b 1000 feet,

 c. 2000 feet,

 d. 3000 feet.

4. If there were 4” of newly fallen snow how much of an increase in IR intensity on vertical structures 40 feet high ,based on the calculations from question 3, from the center of the fire at a pipeline depth of 4 feet, at the following distances:

 a. 500 feet

 b. 1000 feet

 c. 2000 feet

 d. 3000 feet

5. Please provide all historical data of all fires started by or augmented by a large IR intensity signature such as Dresden, Germany in WWII, and in the US, Chicago and San Francisco fires.

E. If the rupture and fire took place in the late fall with dead leaves still on the trees (later in the fall than Exhibit D) there would be a large fire or firestorm. Use the photo of the CP in Exhibit D. to understand the scope, maturity and density of the forest opposite Worcester. Much of the primary (blue) route and route M pass by and through large tracts of forest.

1. What plans are in place along the entire primary pipeline (blue), or the alternative M (red), to deal with such a large explosion and fire?

2. List the assets that each town traversed by the CP would need in order to fight a large forest fire, and at the same time as buildings would be burning.

3.What would be the additional cost to each town in question 2 in:

a. Equipment.

b. Number of firefighters.

c. Cost of additional insurance to the fire-fighting organizations.

1. List all the hospitals along all the proposed routes of the CP and indicate which ones have facilities to treat burn and trauma victims and the number of beds specified for those injuries.
2. If there are not enough facilities present, how long before these facilities could be built and staffed to be able to accept (for example) 400 burn and trauma casualties?
3. List all the burn units in a radius in miles from Worcester that would be needed to accept 400 burn victims?
4. What would be the time to transport them to burn units listed in 6.?
5. What means of transporting are you using to transport the victims if question 7.
6. What would be the cost to each county to build and maintain a facility to deal with the burned and injured individuals not only in the MKZ but also due to forest fires?
7. List what assets and equipment would be needed, such as helicopters, to take the large numbers of injured to burn and trauma units.
8. If you propose to use triage because of limited resources please list in complete detail all of the components of that plan.
9. In answer to question 11. list in complete detail the nature and extent of those injuries that citizens and rescuers would sustain that would allowed them to die without medical attention.
10. Please list in complete detail the cost in economic terms of taking care of the burned and injured that survive, after the triage of 400 individuals. You can base you answer again on the experience of NYC in 2001 World Trade Center disaster.

 14. In the Carlsbad fire 26 firemen were injured and sued El Paso. I think that it would be a fair assumption that most of the brave firemen in Worcester would be injured or killed in a vain and valiant attempt to save the children in the school and other affected citizens. Describe in complete detail the projected economic and psychological loss for the Worcester community.

 15. It would be a physiological disaster for the emergency responders in Otsego and adjoining counties. One can again use the economic model used in the World Trade disaster. Most of us know or have met people whose lives have been changed by that traumatic experience. Calculate the economic cost to each Town, County and States that the CP primary and all its alternatives traverse over a period of:

1. One month.
2. One year.
3. Five Years.
4. 10 Years.

EXHIBIT R. (ng-El Paso CraterDOC001.pdf) is the photo on pg. 11 of Exhibit A.

EXHIBIT G. From the website <http://www.ees.nmt.edu/outside/Geop/Pipeline/pipeline.html>

**Forensic Seismology: New Mexico Pipeline Explosion Seismic Study**

“Under the simple assumption that the energy in each explosion is proportional to the square of the recorded ground amplitude, and normalizing by the amplitude and energy of the first event, we can crudely estimate the relative energy in each blast, from CL2B we have

#1 05:26:28 MDT Energy: 1
#2 05:26:52 MDT Energy: 11.8
#3 05:27:10 MDT Energy: 5.8

# 1 is the rupture of the pipe and the blowing out of the un-ignited gas which created the deep trench.

Between #1 and #2 is the time period of 24 seconds. #2 Is energy of the initial ignition of the gas that had escaped.

#3 was a secondary explosion or the seismic energy from the large amount of energy being released by the fire.”

We know that the gas was flowing from two open pipe ends in a trench and was directed upwards by the 20-feet high trench. The gas pressure was 675 psi from two 30 inch diameter pipe ends.

**We can see from Exhibit C.** (ng-El Paso Air Photo DOC000.pdf) From Pg.4, Figure 4. I have plotted the distance from the center of the fire to the end of the photograph of the bridge which is 1012 feet. This is not the end of the bridge but the limit of the photograph.

From Exhibit A, pg. 12

“The two pipelines that were being supported on the bridges…fell and came to rest on the ground on each side of the river, but neither leaked.”

That was due to the 2nd seismic event, the ignition of the natural gas envelope explosion. Th**e pressure wave was strong enough to blow two large steel pipes off a bridge 1012 +feet away. One would assume that the pipes would have been secured to the bridge by round hoops fastened to the bridge. Any blast this strong would be damaging to people, buildings and vehicles.**

**Since the CP would have a maximum pressure of 1450 psi which would be 230% higher pressure, we can calculate the energy in #2 to be 27.14 times the energy in # 1 . It is hard to imagine the damage that would result from such an explosion!**

**F**. In the El Paso Carlsbad explosion:

1. What was the total volume of gas in cubic feet at ambient temperature at 24 seconds but before ignition?

2. What was the total energy content in question 1, of that gas in Btu before ignition?

3. In the answer to question 2, what would be the equivalent in energy released in pounds of TNT?

4. We know that the estimated seismic energy from the second blast was 11.8 times the first event. The gas was still venting from two brakes and adding to the gas in the fireball. What is the estimated diameter and height of the fireball 1,2,4,8, and 10 second after ignition?

5. We know from Exhibit A, Damage Report, Pg. 12, “The two pipelines that were being supported on the bridge…fell and came to rest on the ground on each side of the river, but neither leaked.” It can be assumed they were secured by metal hoops secured to the bridge (as is common practice) and were blasted off by the initial fireball. What was the projected blast force on the ground in pounds per square yard over ambient pressure at various distances:

a. 100 feet

b. 500 feet

c. 1000 feet

d. 2000 feet

6. What would be the combined IR signature of all frequencies in watts per square meter at the following distances:

 a. 500 feet

 b. 1000 feet

 c. 2000 feet

7. If the CP ruptured, operating at 1450 psi and buried at a depth of 4 feet with gas escaping from two sides of the break. Since the ejected gas would be more parallel to the surface, not having a deep trench to direct its gas vertically, the natural gas envelope would be lower to the ground and have a greater diameter than in the Carlsbad incident. What are your estimations as to the diameter and vertical altitude of the gas plume 24 seconds after the initial break but before ignition?

8. What would be the dimensions of the fireball still being augmented by two brakes emitting gas at 1450 psi:

 a. 1 second after ignition.,

b. 2 seconds after ignition

c. 4 seconds after ignition

d. 8 seconds after ignition

e. 10 seconds after ignition?

9. Taking the conditions calculated in question 8, what would be the highest blast pressure as measured from the center of the rupture in pounds per square yard:

a. 500 feet

b. 1000 feet

c. 2000 feet

d. 3000 feet

10. What was the total energy content in question 7, of that gas in BTU before ignition?

11. In the answer to question 10, what would be the energy equivalent in pounds of TNT?

**G**. We can see from Exhibit C., Fig 4, that the air was clear, and on August 19 at 5:26 PM the earth was beginning to cool but was probably still close to 90 degrees F.

In the following hypothetical condition, but not unusual for Worcester, NY, where in the autumn before the leaves fall, it can go down to below freezing. On cold morning 32 F, at 8 am with a clear sky, a 0 mph velocity of wind, and with a temperature inversion over the Worcester Valley (as we who live here and burn wood can see on a regular basis), the smoke rises up to 50 feet to 100 feet, where the smoke stops rising ,levels off and drifts slowly parallel to the ground there was a catastrophic break in the CP mile marker 50.2; the two environments (Carlsbad and Worcester) would have different effects on:

1. The shape of the natural gas envelope’s pre-ignition dimensions.
2. The bottom of the gas envelope’s altitude above the ground.
3. The shape of the fireball.
4. A different pressure impact on the ground.
5. A different IR signature.

**H**. If the CP pipeline was buried 4 feet deep and the gas was approximately 32 F degrees and at a pressure of 1450 psi and there was a catastrophic break in the pipe, as in Carlsberg, prior to ignition 24 seconds after the initial break from two ends of the pipe, the gas would experience a great reduction in pressure and cooling.

1. 24 seconds after the initial break and the released gas that came to ambient pressure, what would be the temperature of the natural gas prior to ignition?
	1. Question 1. allows one to calculate the increased density of the natural gas and energy content of the gas envelope. Taking the preceding scenario of the weather in Worcester at moment of CP pipe failure, calculate the diameter and height above ground of the gas envelope at 24 seconds prior to ignition.
	2. What would be the total energy content of the gas envelope in pounds of TNT prior to ignition?

 c. What would be the pressure impulse after ignition, considering that burst pipeline would still be adding gas (energy) to the fireball 1, 2, 4, 8, and 10 second after ignition in **pounds per square yard** above ambient pressure at the following distances:

1. 500 feet

2. 1000 feet

3. 2000 feet

4. 3000 feet

 d. In Worcester most of the buildings are of wood. What damage could be expected to the average wood house built in the late 19 century at the following distances:

1. 500 feet

2. 1000 feet

3. 2000 feet

4. 3000 feet

 e. What would be the combined IR signature of all frequencies in watts per square meter at ground level including the still escaping gas at 1, 2, 4, 8, 10 seconds after ignition at the following distances:

 1. 500 feet

 2. 1000 feet

 3. 2000 feet

 4. 3000 feet.

f. . If there were 4 inches of newly fallen snow, with a reflectivity index of .90, how much of an increase in IR intensity on vertical structures 30 feet high based on the calculations from question e., from the center of the fire at a pipeline depth of 4 feet, at the following distances:

 1. 500 feet

 2. 1000 feet

 3. 2000 feet

 4. 3000 feet

**III.** **Watershed in Worcester, NY and along the entire primary and alternative route M.**

EXHIBIT E. Is the tax map of Worcester.

EXHIBIT D. Is a copy of the CP map showing route M at the 50 mile marker.

EXHIBIT I. ng-hydroquest-Shale-Gas-Geological-Problems. (1) pdf

 Hydroquest analysis of the danger to aquifers and specifically NYC aquifers.

One can see that the CP will go directly through the Worcester aquifer described by the closely spaced parallel lines in Exhibit E.

From (Exhibit I) On pg. 2, Fig 1., one can see that the Worcester watershed (the Unadilla Fm, blue) valley stream (black squiggle line that parallels I-88 the proposed alternative M) that traverses Worcester watershed can communicates with the Schoharie Reservoir for NYC. Any spills or pollution in building or in an accident will have an impact on the watershed for NYC.

 One can also see where the CP proposed primary route would travel through Delaware and Schoharie County (The Oneonta FM, yellow) communicates with the Cannonsville Resvoir, Pepacton Reservoire, Ashokan reservoir and Schoharie Reservoir.

The CP primary route and alternative M travel through Karst formations.

From (Exhibit I.) pg.2,3. “Carbonates of the Onondaga Formation and Helderberg group outcrop in the northern portion of Otsego County.” and much of Schoharie County.

“…An important aspect of karst is its effect on water supply and contaminant transport. Water in solution conduits can travel up to several kilometers per day, and contaminants can move at the same rate. This poses serious problems when monitoring for water quality. Contaminants enter the ground easily through sinkholes and sinking streams, and filtering is virtually non-existent. Even small solution conduits can transmit groundwater and contaminants hundreds of times faster than the typical un-enlarged fracture network.”

1. If there was catastrophic break at mile marker 50.2 in the CP and an explosion and fire, in the Town of Worcester, what would be the cumulative consequences to the Worcester aquifer by the release of toxins in air and water?
2. List the cumulative impact and consequences to other groups of citizens that are down-gradient from Worcester such as NYC and the Delaware River System and Susquehanna River System.
3. List in complete detail where the primary (blue) route and the alternative M (red) route are placed in watershed areas.
4. If there was a spill of toxic chemicals during construction or an a break in the pipe that caused massive destruction through fire, and the attendant effects of extinguishing those fires, releasing toxins into the air and water in an area of karst. List the cumulative impacts of such an event on the ground waters of all communities that would be affected.

**IV. Geological faults in the primary route and alternative M route.**

**Exhibit H.**

**Frack\_earthquakes\_JacobiTectonicsNYS. (1).pdf**

Jacobi, R.D., 2002, Basement faults and seismicity in the Appalachian Basin of New York State in Neotectonics and Seismicity in the Eastern Great Lakes Basin, R. Fakundiny, R. Jacobi, and C. Lewis (eds.): Tectonophysics, v. 353, pages 75-113.

**Exhibit I.**

**Ng-hydroquest-77649401-Shale-Gas-Geikigucak-Problems (1).pdf**

<http://www.scribd.com/doc/77649401/Shale-Gas-Geological-Problems>

HydroQuest September 11, 2010

Comments on the Scope of the EPA’s Proposed Study of Hydraulic Fracturing

**Exhibit J.**

**frack\_earthquake\_NYC Watershed map segment-1.pdf**

**NYCDEP WOH Non-Watershed Infrastructure Impact Evaluation Figure 1**

**Hager-Richter Geoscience, Inc. Salem, New Hampshire, December 21, 2011**

[http://www.nyc.gov/html/dep/pdf/natural\_gas\_drilling/hager-richter\_technical memorandum\_20111221\_hydrofrac.pdf](http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/hager-richter_technical%20memorandum_20111221_hydrofrac.pdf)

Shows four more major seismic faults in Delaware County in addition to Jacobi’s three.

**Exhibit K.**

<http://dmna.ny.gov/news/news.php?id=1257468759>

When asked about earthquakes in the area, Jacobi pulls out a computer-generated state map, cross-hatched with diagonal lines representing geological faults.

The faults show that past earthquakes in the state were not random, and could occur again on the same fault systems, he said “In Western New York, 6.5 magnitude earthquakes are possible,"

Earthquakes up to 7 magnitude have occurred in the North Eastern part of the continent, and this scenario was calibrated on the magnitude 5.9 earthquake, which occurred in Saguenay, Quebec in 1988, said Jacobi and Professor Andre Filiatrault, MCEER director. He (Jacobi) and other earthquake experts impaneled by the Atomic Energy Control Board of Canada in 1997 found that there is a 40% chance of 6.5 magnitude earthquake occurring along the Clarendon-Lyndon fault system, which lies about halfway between Buffalo and Rochester, Jacobi added.

Jacobi and Filiatrault said that the soft soil of Western New York, especially in part of downtown Buffalo, would amplify tremors, causing more damage.

“It's like jello in a bowl,” said Jacobi

Jacobi Called **Exercise Vigilant Guard** “important and Illuminating.””

**Exhibit L.**

<http://dmna.ny.gov/news/news.php?id=1257353863>

“According to Dr. Robert D. Jacoby [*sic*: Jacobi], PhD, University of Buffalo professor of geology the likelihood of a significant seismic event occurring in…NY is not as remote as one would think." “During the past 20 years, geological research that I have conducted with my colleagues at the University of Buffalo and other institutions, has led to an understanding that, contrary to the conventional wisdom, Western New York, in fact, the entire state, is crisscrossed by literally hundreds of faults," he said. “many of them, including the largest in our area, the Clarandon-Lindon Fault, remain seismically active today."

**Exhibit M.**

<http://www.innovateus.net/content/there-non-newtonian-fluid>

The basic behavior of **Non-Newtonian fluids** has very important areas of interest which need pondering. They convey that no matter how strong the foundation of a building is, when an earthquake occurs, its pressure puts stress on the clay and building material and this sudden vibration may make all of it to turn like a liquid thereby causing damage.

**Exhibit N.**

**Exhibit\_ N\_ USGS EARTHQUATE DATA BASE.pdf**

**For- 42.64N 74.63E**

 Shows 44 earthquakes in a 60-mile radius from Worcester through the time period of 1973 through 2011. **Two of these were 8 years apart, with a magnitude of 4.4 and 4.8, and the epicenter for both was approximately 8 miles away!**

From Exhibit A.

Pg. 13. Metallurgical Examination

 “…no evidence of corrosion on the outside of the pipe or the internal surface across the top half of the pipe… Sever [*sic*: Severe} wall loss due to corrosion was observed on the inside of the pipe at the bottom. …the most severely corroded area reduced the original pipe wall thickness by 72 percent,…”

**Exhibit O.**

**Exhibit\_O\_USGS\_ Historic\_Earthquake\_** **ISOSEISMAL\_MAP.pdf**

In 1944 a magnitude 5.8 earthquake affected Worcester with an intensity level of was 5. Level 5 included all of alternative M in Otsego County and the primary CP blue route in Delaware County. The rest of the CP routes were either in the level 4 or 5 intensity zones.

**Exhibit** **P.**

[**http://www.nyc.gov/html/dep/pdf/natural\_gas\_drilling/nycdep\_comments\_on\_rdsgeis\_for\_hvhf\_20120111.pdf**](http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/nycdep_comments_on_rdsgeis_for_hvhf_20120111.pdf)

 **The City of New York submits the following comments on the Revised Draft Supplemental Generic Environmental Impact Statement (RDSGEIS) on the Oil, Gas and Solution Mining Regulatory Program**

**H**. By looking at **Exhibit H,** Jacobi’s map of major faults shown in Tectonophysics #353 (2002), pg. 78 and 86, one can see the CP route M and the primary route both are in a high-fault area and run parallel to a long and active fault line. In Exhibit I. pg.2-5 and Fig. 3,4, “Jacobi and Smith (2002) document the epicenters of three seismic events in eastern Otsego County. Importantly, Figures 3 and 4 provide a very conservative approximation of the actual number of fractures and faults present throughout Otsego County and New York State. In establishing a relationship between seismicity and faults, Jacobi (2002) examined Fracture Intensification Domains (FIDs), E97 lineaments (Fig. 3), topographic lineaments, gradients in gravity and magnetic data, seismic reflections profiles, and well logs. Jacobi states:

*“In interbedded shales and thin sandstones in NYS, fractures within the FID that parallel the* FID characteristically have a fracture frequency greater than 2/m, and commonly the frequency is an order of magnit*ude greater than in the region surrounding the FID”.”*

And as Jacobi realized this is not a complete catalogue of faults. This can be seen in **Exhibit J**., where Jacobi shows 3 faults in Delaware County and also shows an additional 4 faults were identified, for a total of 7 faults. It can be seen the CP pipeline travels into and ends in, Schoharie County, which has had multiple earthquakes and major faults that are parallel to and are bisected by other major faults. From a seismological point of view it is probably one of the worst places in the region to put a new pipeline. NYS government is trying to close down Indian Point Nuclear Reactor because it is on a fault line, and after Fukushima we realize how hazardous it is to put infrastructure that can become dangerous on quake-prone areas. The Japanese went back 400 years to prepare for the worst earthquake, but they failed to consult records back for 800 years, which would have had them build a higher seawall. Human life is so short in geological time that we have difficulty in preparing for events that may happen on a 1000-or 2000-year time frame when we plan for 40 years or tomorrow. But those events will happen. Look at how quickly San Francisco was rebuilt on an active fault. Look at Naples, Italy that was rebuilt at the base of an active volcano. These impending tragedies have been implemented by people who did not have the scientific understanding that we now have acquired. **Is FERC not going to use that latest scientific insight and methods to avert a potential disaster, another gas line, in a fault-prone place of high seismic activity?**

In 2009 Jacobi was quoted : **Exhibit L**

<http://dmna.ny.gov/news/news.php?id=1257353863>

**“…in fact, the entire state, is crisscrossed by literally hundreds of faults,…many of them remain seismically active today."**

**Exhibit J.**

<http://dmna.ny.gov/news/news.php?id=1257468759>

When asked about earthquakes in the area, Jacobi pulls out a computer-generated state map, cross-hatched with diagonal lines representing geological faults.

“The faults show that past earthquakes in the state were not random, and could occur again on the same fault systems…”

 “It's like jello in a bowl,” said Jacobi

**The CP line M would be positioned not only on alluvium soil in the Town of Worcester but also along much of the entire route .**

In Exhibit J. Jacobi uses the word “jello” to describe the effects on alluvium and fine grained soil by an earthquake.

To understand “jello**”** better:

**Exhibit K.**

<http://www.innovateus.net/content/there-non-newtonian-fluid>

“The basic behavior of **Non-Newtonian fluids** has very important areas of interest which need pondering. They convey that no matter how strong the foundation of a building is, when an earthquake occurs, its pressure puts stress on the clay and building material and this sudden vibration may make all of it to turn like a liquid thereby causing damage.”

To understand how the CP would be affected by building it in an earthquake-prone area and on alluvium soil acting as a Non-Newtonian fluid, the pipe would sink in some areas and not in other areas with a different earth structure. This would cause dips in the pipe, if not fractures, which would allow acidic fluids to pool and cause thinning of the bottom of the pipe as in the Carlsbad pipeline leading to structural failure.

1. **FERC must take into considerations not only the fault lines near the CP but the interaction of intersecting faults.** That was one of the lessons of the Fukushima disaster when 5 faults interacted in a series because when the strain was released on one it then increased the stress on the others.
2. What model is FERC using to determine the probabilities of a magnitude 3,4,5,or 6 earthquakes in areas of multiple closely spaced and intersecting major faults and fractures?
3. Show all the faults along the primary Blue line and the alternative M (red line) using only the latest technology such as GSI3D or more advanced and effective proven technology by independent parties and subject only to independent scientific peer review.
4. Predict the largest seismic events every one-tenth of a mile on the primary route and alternative route M?
5. Describe in detail what seismic model that was used in question 3.
6. Jacobi places a 4.5 to 4.9 earthquake in East Worcester very close to the Schoharie County border and route M runs over it. **How does FERC justify this insanity?**

**Exhibit O.**

**Exhibit\_O.**  **USGS Historic Earthquakes** **ISOSEISMAL MAP.pdf**

In 1944 a magnitude 5.8 magnitude earthquake affected Worcester with an intensity level of 5. The intensity level of 5 included all of Otsego County, and much of the parts of the CP primary line in Delaware County. The other areas of the CP would have experienced an intensity of 4 or 5.

**Exhibit S.**

**Exhibit\_S-Jacobi-intersecting faults.pdf**

**J**. From **Exhibit H.,I.,J., S. Both the primary route and route M travel along Otsego County and Delaware County, along two long parallel faults, parallel to the Susquehanna/Scranton Gravity High, that are bisected by a number of faults including the Sprakers and Noses .** To get an idea of the number of faults, one needs to compare Jacobi’s map of major faults, and Jacobi’s map of minor faults, and then project the faults in **Exhibit J**. which shows the three major faults by Jacobi in Delaware County and an additional four faults computed from earthquakes, and geological anomalies logged when the NYC built their water tunnels that Jacobi was unaware of. **That means that Jacobi under-reported the number of faults major faults in Delaware County by 57%.**

It can be inferred that the CP travels through additional major faults in all of its length including Chenango and Broome Counties into Pennsylvania that are most assuredly present but are unknown. Before the pipeline can be considered, an exhaustive examination of the primary blue and the alternative M red need to be mapped for geological faults using the most modern techniques and not rely on old, outdated maps.

**FERC must develop a plan for exposing the geological hazards and publish it for scientific peer review before the Constitution Pipeline can be considered.**

**If it is deemed necessary to have additional supplies of natural gas only existing routes that gas lines are already on should be used to reduce the number of potential accident points.**

Yes it may cost Williams and Cabot more money to build the CP alongside another pipeline, but gas pipelines earn a 20% rate of return whereas the S&P earns 5% according to oil and gas industry publications.

Another consideration for not building the CP pipeline is that, that it is an open access pipeline, and able to accept gas from wells that are drilled nearby.

The CP primary pipe line route and alternative route M run along a major fault lines and hydro-fracking has been shown to cause seismic events in the following citation.

**From (Exhibit P. pg 6-7)**

“The underlying geologic mechanisms of induced seismic activity from underground injection wells and from HVHF [High Volume Hydraulic Fracturing of shale to release gas] are the same – fluid injected underground migrates to a fault and triggers a seismic event.

 Small induced earthquakes are events with a magnitude greater than these microseisms but less than or equal to magnitude three (3) on the Richter scale. These induced earthquakes are believed to occur when drilling activities allow fluids to “lubricate” a fault zone, resulting in small earthquakes. Recent Evidence of Earthquakes Triggered by HVHF

While HVHF is a relatively new technology, two recently released technical reports now directly link shale gas HVHF to induced seismicity. The first report, commissioned by a gas production company, investigates earthquakes from a vertical shale well near Blackpool, UK.

 Hydraulic fracturing of the Preese Hall Well was shown to have caused earthquakes of magnitude 2.3 and 1.5, as well as 48 earthquakes of smaller magnitudes. In those cases, earthquakes were induced when HVHF fluids migrated into a previously unmapped fault that does not extend to the surface and was therefore undiscovered by superficial mapping.

The second report concerns the Eola Field of Garvin County, Oklahoma, and was conducted by the Oklahoma Geological Survey. There, forty-three earthquakes ranging in magnitude from 1.0 to 2.8 on the Richter scale occurred within approximately 2.2 miles of the vertical well soon after HVHF commenced. This area is naturally seismically active, which complicates the analysis. However, the timing, location and frequency of earthquakes can provide a convincing technical connection, and in fact the Oklahoma Geological Survey found that the temporal correlation of HVHF and the earthquakes, as well as modeling conducted using a simple pore pressure diffusion model, indicated that the earthquakes were likely induced by HVHF. Now that a direct link has been made between HVHF and induced earthquakes, other past instances of possible HVHF induced earthquakes will likely be examined.”

From Exhibit H pg.110, Jacobi warns that us that “The high number of faults means that most cultural facilities (e.g., waste disposal sites, bridges, **pipelines**) **are not far from a potentially seismically active fault**.”

 Williams promotes the project to its investors as being a gateway for and development of newly hydro-fracked areas. **FERC does not have the mandate to control where or how hydro-fracking is to be done. Therefore, FERC must deny the application.**

**j.** **The CP will be in a highly active geological area and there is a very high probability that in one or more of these events the following will happen:**

1. The pipe will be stressed at various places causing a stress fracture or a fracture and a resulting explosion.
2. In an earthquake the pipe will be move up and down and cause dips in the pipe and that will be places for corrosive fluids to accumulate as in the Carlsbad case, which ultimately caused an explosion.
3. Since the CP is an open access line there may be either intake or outflow points that may move at a different frequency in an earthquake and causing stress or breaks at those points, ultimately causing an explosion.
4. HVHF will lubricate faults, causing earthquakes and leading to incalculable risk and explosions.

**V. Pipeline inspections do not eliminate explosions.**

From (Exhibit A. Pg. 21.) “The line 1103 the right –of –way had most recently (before the accident) been inspected on August 11, 2000, by aerial patrol and on August 18, 2000 by ground patrol. Inspectors looked for evidence of leaks (such as discolored soil or dying vegetation), erosion, and excavation near the pipeline. No leaks were reported.”

**The Carlsbad pipeline exploded one day later.**

**VI. In the US pipeline safety is left to private firms that are not under the control of the US Government.**

**Exhibit Q.**

 The U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Document CPF 3-2010-5002W, to Endbridg Energy Partners LP “…you have committed a probable violation of the Pipeline Safety Regulation , Title 49, Code of Federal Regulation”

**The EL Paso pipeline 1003 was inspected 1 day before it blew up.**

**Neither FERC nor can the citizens of NYS rely on inspections to prevent accidents. Accidents can only be prevented in the initial design stages of a project!**

The Challenger accident was due to political pressure for a launce.

The BP disaster in the Gulf was due to pressure from BP to save drilling expenses

 Enbridge Energy ruptured, spilling more than 843,000 gallons of tar sands oil into Talmadge Creek and the Kalamazoo River because they did not take prescribed actions to ascertain and prevent corrosion of the oil pipeline.

The exact same behavior that the owners of the El Paso pipeline had done a decade earlier.

It reminds me of a song “**when will they ever learn**”.

Human error is the weak spot in any high risk enterprise.

From Scientific America, May 2012, Pg. 26. “In a recent report from Russia’s space agency sheds light on a string of recent failures. …But it is the **nature of the apparent causes of the accidents**-**often amazingly inept human errors**-**that seem most alarming**.” [Emphasis mine.]

From (Exhibit P. pg 3)

 “Even with a robust regulatory program in place, …, **failures due to human error or natural disaster are inevitable.”** [Emphasis mine.]

1. **CONCLUSION:**

**We cannot allow dangerous projects to be built in dangerous areas and hope that humans have the will, ability, and integrity to prevent them. There is a history of human behavior causing accidents to happen regardless of whether the dangers were unknown, ignored or because proscribed procedures were not followed. Because of the overwhelming evidence presented, FERC, in the planning stage of this project, must recognize existing hazards that cannot be mitigated, and the history of accidents, and must deny both the proposed primary route and the alternative route “M” for the Constitution Pipeline.**

Sincerely,

Clark J. Rhoades