PINEDALE ANTICLINE PROJECT OFFICE (PAPO)

1625 West Pine
PO Box 768
Pinedale, Wyoming 82941
Attention: Project Coordinator 307-367-5386

APPLICATION FOR FUNDING

(use additional sheets if necessary)

1. GENERAL PROJECT INFORMATION

Project Name: Investigating the Potential Influence of Natural Gas Drilling Wells on Surface Water in the Pinedale Anticline: A Monitoring Plan for the New Fork River

General Location (distance and direction from nearest city/town, attach map at a scale not less than ½" = 1 mile): New Fork River near Pinedale (approximately from the highway 191 crossing west of Pinedale south to the Highway 351 crossing southwest of Pinedale).

Legal Location of Project (attach map at a scale not less than 1" = 2,000').

Township: T 33 N	South to: Township: T 30 N
Range: R 109 W	Range: R 109 W
Section(s): 5	Section(s): 5
County: Sublette	County: Sublette

Surface Ownership (check all that apply): Federal X State X Private X

**If project includes a mosaic of land ownerships (e.g., mix of federal, state and/or fee lands), provide a breakdown for each specific owner by acres and percent of total project area.

Ultimate site selection will be determined with input from the US BLM, Wyoming Game and Fish Department, the Sublette County Conservation District and other concerned parties. The placement of the sites will coincide where possible with current biological sampling efforts. All appropriate documentation of permission will be obtained before any work is initiated on private property. Field efforts will be conducted on privately held sections only where cooperating land owners have indicated a desire to evaluate water quality. Preliminary consultation with WGFD aquatic biologist Floyd Roadifer indicated there were many land owners willing to allow access for the placement of passive sampling devices.

Contact Information for Affected Parties or Agencies:

David Harper, USGS – CERC, Jackson Field Research Station
P.O. Box 108
Jackson, WY 83001
307 733-2314 ext. 14
david_harper@usgs.gov

Or Aïda Farag, USGS, CERC, Jackson Field Research Station Address same as above 307 733-2314 ext. 11 307 690-6525 cell aida_farag@usgs.gov
2. APPLICANT INFORMATION
Name/Organization: David Harper and Aïda Farag, USGS - Columbia Environmental Research Center, Jackson Field Research Station
Mailing Address: PO BOX 1089, Jackson, WY 83001
City: Jackson *State:* Wyoming *Zip Code* : 83001
Daytime Phone # 307 733-2314 ext. 14 or 307-360-6146(Th and Fri) *Fax #* 307-739-9268
Email Address: david_harper@usgs.gov or aida_farag@usgs.gov
Point of Contact (if different from above)

3. PROJECT DESCRIPTION

General Project Type (check all that apply):

Land Use/Livestock _____	Land Use/Recreation X- Fishery___
Cultural _____	Wildlife X – Riparian and Aquatic life_____
Air _____	Other _____X_____

Describe Project Proposal (e.g., mechanical treatment, water improvement, etc.)

The New Fork River in southwest Wyoming supports a healthy trout population and is a popular recreational fishery. The New Fork is classified as a class 2 water body (waters known to support fish or drinking water supplies) by the Wyoming Department of Environmental Quality. This river is used extensively for irrigation and stock watering. Since 1999, the area surrounding the New Fork River has seen large-scale drilling for natural gas in the Pinedale Anticline. Up to 700 producing well pads may be constructed within the Pinedale Anticline management area, with the rate of exploration contingent on the price of natural gas. Groundwater monitoring in the Pinedale Anticline was initiated in 2004 to assess the effects of natural gas well drilling on groundwater quality. Hydrocarbons, including known carcinogens such as benzene have been detected in groundwater at concentrations that exceed state and federal water quality criteria. The specific source of contamination is unknown; however the remote nature of the area and the lack of industrial activity other than natural gas drilling suggest that hydrocarbons enter the groundwater through activities associated with natural gas extraction, transmission or associated infrastructure construction.

Surface waters within the Pinedale Anticline drilling area have not been monitored extensively for hydrocarbons; however there is the potential for hydrocarbons to enter surface water through several sources associated with natural gas extraction. These include drilling fluids, fracturing fluids, solvents, condensate, wastewater discharge, water collection trucks, road and pipeline construction equipment and their associated lubricating fluids and solvents. Adequate monitoring would provide the ability to define infiltration of hydrocarbons to surface water, should it occur. Furthermore, a properly designed monitoring plan would alert management agencies to potential issues by defining the presence of hydrocarbons before they reach concentrations that would cause concern for public and environmental safety. Three potential sources of hydrocarbons entering surface water are; 1) natural gas wells near the New Fork River where proximity to the river allows short transit times for potential hydrocarbons in the groundwater to enter the river, 2) through seeps and/or springs that become sources of hydrocarbons to surface water via groundwater from distant activities associated with natural gas well drilling 3) from natural gas well drilling and industrial activities that occur in or near ephemeral draws, where hydrocarbons within the soils may be flushed to surface waters during periodic spring runoff or flash flood events.

Exposure to hydrocarbons can impact both human health and the environment. Solvents such as benzene are known carcinogens at seemingly small concentrations of exposure (USEPA 2003). Because hydrocarbons are lypophilic, or "fat loving" they can bioaccumulate in animal tissues, and can have adverse health effects, even where concentrations are relatively small (Fabacher 1991). Hydrocarbons can also accumulate in the sediments of aquatic habitats (Baumarda et al.1998) where they can slowly be released and remain as a source of exposure for many years following the initial accumulation.

The USGS, Columbia Environmental Research Center (CERC) has extensive experience detecting, evaluating and monitoring hydrocarbons in aquatic systems. One method to monitor potential hydrocarbon infiltration to surface waters is through the use of semi permeable membrane devices or SPMD's. These lipid filled semi-permeable membrane sacks or "fat bags" can be placed into a body of water for up to 3 months. When hydrocarbons come into contact with the SPMD, they are absorbed and stored, acting as surrogate for an aquatic organism. SPMDs, a tool derived by CERC will be used to assess the movement of hydrocarbons into the surface water. The SPMD's will be placed in the river for consecutive 3-month periods during two consecutive years to detect spills or random peaks in hydrocarbons entering the river that might be missed by periodic sampling. A total of 10 sites (including a reference site above natural gas drilling activity) will be investigated.

After 1 year, sediments from the river substrate would be collected for the presence of hydrocarbons at the site of each SPMD deployment during both years. Pore water, defined as the water held within the sediments, would also be collected and used to perform toxicity experiments with *Ceriodaphnia dubia* (water fleas) to assess the acute and chronic toxicity of the sediments and their associated waters.

Ultimate site selection will be determined with input from the US BLM, Wyoming Game and Fish Department, the Sublette County Conservation District and other concerned parties. The placement of the sites will coincide where possible with current biological sampling efforts. All appropriate documentation of permission will be obtained before any work is initiated on private property.

Total Project Acres (if applicable)

Acres Indirectly Affected (if applicable, explain)

4. OBJECTIVES OF PROJECT, AND BENEFITS TO PAPO OFF-SITE MITIGATION STRATEGIC GOALS.

The goal of this study is to define the potential accumulation of hydrocarbons in surface waters of the New Fork River and to establish a monitoring plan for the New Fork River. One method to monitor potential hydrocarbon infiltration to surface waters is through the use of semi permeable membrane devices or SPMDs. These lipid filled semi-permeable membrane sacks or "fat bags" can be placed into a body of water for up to 3 months. When hydrocarbons come into contact with SPMDs, they are absorbed and stored as might occur in aquatic organisms. As such, the SPMD acts as a surrogate for an aquatic organism. The deployment of SPMDs for an extended period of time can also provide a history of exposure to hydrocarbons at the site. The ability to record the exposure history could be particularly useful in the New Fork River, especially at the confluence of wetland and springs near drilling activity and ephemeral draws that experience only periodic immersion. A baseline of toxicity data would enhance the dataset provided by the deployment of SPMDs. If hydrocarbons are detected (either during this study or in the future), a monitoring plan that includes bioassays would define whether the concentrations noted could affect aquatic life on site. A baseline of toxicity data provided at this time would also minimize the need for a reference site if toxicity bioassays were needed in the future because one could compare data from future studies to those collected during this current study. Water chemistry, temperature and storm runoff can affect the solubility and movement of hydrocarbons. To monitor the exposure history of the SPMD's, multiparameter data loggers will be deployed at a minimum of 5 sites to measure conductivity, dissolved oxygen, pH, and temperature throughout the study period. These data will also provide a record of unusual events that may cause changes in the general water chemistry during each time frame for the SPMD deployment. The USGS Jackson Field Research Station currently has 3

multiparameter data loggers.

5. DIRECT/INDIRECT EFFECTS ON OTHER RESOURCES. (if applicable)

If hydrocarbon seepage into the New Fork River occurred, and it reached concentrations determined as toxic to aquatic invertebrates, indirect effects may be observed for recreational fisheries and wildlife that frequent riparian zones. The state of aquatic invertebrates are not only indicative of aquatic health, they serve as a food source for fish in the New Fork River. Efforts to monitor potential toxic effects of hydrocarbon effects on aquatic invertebrates would provide and early detection of possible threats to the sport fishery populations. Potential seepage of hydrocarbons into the New Fork River water and sediments could also provide a route of exposure for wildlife (e.g. birds, mink, otter) that frequent riparian zones. As a result, data from this study could be used to assist managers of both sport fisheries and wildlife.

6. POTENTIAL FOR FUTURE EXPANSION OF PROJECT. Explain

This project could provide the framework for future long-term monitoring of hydrocarbons in the New Fork and other streams in Sublette County associated with natural gas extraction. Once the initial methodologies are established, monitoring could be continued through cooperative agreements with other county, state and federal agencies or private contractors.

7. LIST ALL PROJECT PARTNERS/COOPERATORS, THEIR ROLES AND/OR CONTRIBUTIONS

Wyoming Department of Environmental Qualtiy. The Wyoming DEQ will play an important role in helping to identify the most likely contaminants associated with natural gas drilling operations. A letter of support is attached.

Wyoming Game and Fish Department. Assistance in determining sampling sites and land owner contacts. Letter of support is provided.

Sublette County Conservation District. Cooperation and assistance in determining sampling locations and land owner contacts.

8. PROJECT MONITORING AND REPORTING (Describe how monitoring and reporting will be done, and how it relates to the objectives)

Progress reports will be submitted quarterly. The final report will be submitted one year after the final field SPMD, pore water, and sediment collections are complete, and six months after the final chemistry and toxicity data are generated. The final report will contain interpretation of data and will undergo peer review as defined by USGS policy before submission to PAPO.

9. RESEARCH POTENTIAL

This study is proposed as an applied effort rather than fundamental research. It is meant to provide technical assistance to the PAPO with the deployment of SPMDs and investigations of potential toxicity of sediment pore waters to aquatic life. If the PAPO is interested, research related to site distribution, uptake, the distribution of hydrocarbons in organisms, and potential modes of toxicity could be investigated. However, we suggest that the proposed effort focus on an applied approach to define the potential seepage of hydrocarbons into water and sediments of the New Fork river.

10. PERMITS AND AUTHORIZATIONS REQUIRED PRIOR TO PROJECT IMPLEMENTATION (including but not necessarily limited to the following):

PERMIT OR AUTHORIZATION	REQUIRED		SUBMITTED		APPROVED	
	Yes	No	Yes	No	Yes	No
Cultural Resource Inventory						
COE Section 404 Permit						
Cooperative Agreement(s)						
NEPA Analysis						
Pesticide Application Permit						
Private Landowner Agreement(s)	X			X		
Sensitive Species Clearance						
Surface/Ground Water Permits		X				
T/E Species Clearance						
Other (explain) will obtain private landowner permission if/when proposal is approved						

11. TOTAL PROJECT COST (Attach detailed budget)

Project Planning and Design	$ 115,448
Project Implementation	$ 250,137
Project Operation and Maintenance	$ 152,305
Total Required	$ 517,890

12. MATCHING FUNDS ANTICIPATED IN CASH (list source and amount)

13. ANTICIPATED "IN KIND" MATCHING FUNDS (list source, valuation, and valuation method)

USGS Salary Jackson Field Research Station, $69,420 (GS-12, 8 pay periods = $ $40,800+ GS-14, 2 pay periods $28,620)

USGS Salary Columbia Environmental Research Center - Chemistry, $56,220 (GS – 11, 6 pay periods = $27,600 + GS-14, 4 pay periods $28,620).

Multi-parameter data loggers – 3 at $6,100 ea = $18,300

Total matching USGS: $143,940

14. PERCENTAGE OF FUNDING ON HAND OR COMMITTED

27.79% as matching salary and equipment.

15. TOTAL PAPO FUNDING REQUESTED: $ 373,950

16. EXPECTED/ANTICIPATED LIFE OF PROJECT (LOP)

Perpetual _____ > 50 Years_____ 25-50 Years_____ < 25 Years__X_____

Explain Basis for Projected LOP: See Project Timeline (#17), project will last 2 years – 1 ½ years of data collection and analyses and 6 months for report generation.

17. PROJECT TIMELINE AND ESTIMATED COMPLETION DATE. Explain

Install SPMD's	4/2012
Collect/ exchange SPMD's	July, October, January and April, 2012 and 2013.
Collect Sediments	April 2013 and 2014
Conduct toxicity experiments with pore waters	May and June 2013 and 2014
Progress reports	Quarterly
Final report	October 2014

18. ATTACHMENTS AND SUPPORTING DOCUMENTATION

Project Design X_____

Letters of Support X_____

Management Plan _____ Long Term _____ Short Term _____ [1]

Monitoring Plan X_____ Long Term _____ Short Term _____ [1]

Relevant Past Experience X____ Other _____ Explain: CVs of Co-PIs will be provided upon request.

[1] Long term is defined as greater than (>) 5 years; short term is less than (<) 5 years.

19. ADDITIONAL INFORMATION FOR PAPO CONSIDERATION

The current proposal has been approved by the USGS through the Fundamental Science Practice program and letters of support for the project provided by the Wyoming Department of Environmental Quality and the Wyoming Game and Fish Department are attached.

20. **ACKNOWLEDGEMENT: this project and requested funding is subject to approval by the PAPO Pinedale Anticline Mitigation Management Board.**

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Signed

David Harper
Printed Name

Fishery Biologist
Title

10/26/2011
Date