U.S. Department of the Interior

Annual Report on Technology Transfer

FY 2012 Activities

January 2013

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I. Introduction

Technology transfer for the Department of the Interior includes a range of activities designed to disseminate scientific and technical information and knowledge between the Department and other Federal and non-Federal entities. It includes but is not limited to publications, exchange of scientific and technical information, protecting and licensing intellectual property rights, and sharing — or otherwise making available — for scientific or technical purposes the expertise and specialized scientific material and resources which the Department manages. In general, technology transfer activities within the Department are consistent with its mission to protect and manage the Nation's natural resources and cultural heritage; to make available scientific and other information about those resources; to honor trust responsibilities to Tribes; and to supply energy for the future.

This report will describe the actions the Department took in FY 2012 to advance technology transfer — from developing therapeutic clays for the treatment of flesh eating bacteria and potential next-generation technologies for water desalination to tracking hydrocarbon plumes in seawater to testing novel products to control invasive mussels that can impair water infrastructure. These activities demonstrate the innovation, expertise and dedication of the Department's employees, including its many scientists and engineers.

II. Advancing Technology Transfer in the Department of the Interior

The FY 2012 enacted budget for the Department of the Interior (Interior) included $822.2 million for research and development. Much of the funding was for applied research ($650.9 million), while basic research and development received $55.5 million and $115.8 million, respectively. The programs supported through these funds generate large amounts of knowledge, information, and technology, which help Interior meet its mission objectives and are transferred to resource managers, stakeholders, and the general public.

The Department's bureaus have varying levels of involvement with scientific and technical research and innovation, and technology transfer. In FY 2012, as in previous years, the majority of technology transfer activities being reported by the Department under the Federal Technology Transfer Act of 1986 (FTTA), was undertaken by the U.S. Geological Survey (USGS). It is the largest research and development (R&D) organization within Interior, both in terms of budget and personnel, and typically accounts for 80% of the Department's R&D budget.

The Department's scientists, engineers and other technical personnel advance the state of knowledge related to the Department's resources, and ensure that this information is accessible to resource managers, private industry, and the general public. The vast majority of the Department's technology transfer activities use traditional technology transfer mechanisms such as publications of peer reviewed papers and reports, webpage postings, and presentations at meetings and conferences. In 2012, USGS and U.S. Fish and Wildlife Service (FWS) personnel, for example, authored or co-authored over 2,300 reports, books, fact sheets, and other publications, including over 1,300 scientific journal articles. Bureaus also use other

conventional approaches to share scientific and technical resources and expertise with each other, universities and other entities to address resource management issues. For example, several are active participants in the network of Cooperative Ecosystem Studies Units (CESUs), a collaboration among 13 Federal agencies (including six DOI bureaus) and over 300 non-Federal partners (including universities, Tribes and tribal organizations, State agencies, museums, aquariums, arboretums, and conservation organizations) organized into 17 CESUs, each hosted by a university.

Bureaus that are active in research and development, or have research capabilities that complement U.S. commercial interests, may also utilize technology transfer agreements authorized by the FTTA to join forces with non-Federal partners. Such agreements allow the Department's bureaus and private sector industries to pool their expertise and resources to jointly create and advance technologies that could help fulfill agency missions while helping U.S. industries innovate and commercialize technologies that can strengthen our national economy and create jobs. This report focuses primarily on the aspects of technology transfer related to the FTTA.

FY 2012 Accomplishments

In FY 2012, the Department continued to build on actions initiated in FY 2011, to institutionalize technology transfer programs within the Department and to enable all bureaus to more effectively and efficiently implement the Federal Technology Transfer Act of 1986 and related legislation while maintaining focus on their missions. In addition to publishing over 2,300 reports, books, fact sheets, and other publications, the Department's scientific, technical and engineering personnel engaged in a broad range of cooperative activities to develop and disseminate innovative technologies.

Other actions in FY 2012 include:

- Collaborating on 379 Cooperative Research & Development Agreements (CRADAs), of which 284 were new that fiscal year. In addition, the Department was engaged in at least 283 other collaborative R&D relationships.

- Disclosure of 10 new inventions. In addition, three patents were filed and three patents were issued.

- Managing 26 licenses for inventions and other intellectual property earning over $78,000.

- Drafting a new Departmental Manual chapter that will establish Department policies and procedures for implementing and administering technology transfer agreements.

Departmental Plan on Technology Transfer

In response to a Presidential Memorandum, the Department submitted a plan in 2012 that commits to:

- Developing a Departmental Manual (DM) chapter specifying general policies for implementing technology transfer (TT) activities authorized by the FTTA, and related legislation (target: June 30, 2013).

- Revising the current DM chapter on patents and inventions which dates to the 1980s (target: December 31, 2013).

- Developing an online repository of documents and legal templates detailing best practices for TT agreements and activities from around the government and elsewhere (target: December 31, 2013).

- Submitting annually to OMB consolidated reports on TT activities and achievements, including analysis of trends in these activities (due every January).

- Developing a unified website to improve public access to information related to inventions owned by the various bureaus, and other technology transfer activities (target: September 30, 2013).

- Developing materials to train bureau R&D personnel in TT activities, including training on relevant ethics and legal issues (target: September 30, 2013).

Progress in meeting these commitments will be documented in future annual reports.

III. Overview of Technology Transfer Activities

Table 1 indicates that Interior's bureaus use, or are contemplating using, a diverse range of mechanisms to transfer information, knowledge and technology within and outside their agencies.

Table 1: Principal Technology Transfer Mechanisms Identified by Each Bureau

FY 2012	USGS	FWS	OSMRE	NPS	BSEE	Reclam-ation	BOEM	BLM
Technical/Scientific Publications	X	X	X	X	X	X	X	X
Workshops/Seminars	X	X	X	X	X	X	X	X
Educational Courses & Other Outreach		X	X			X	X	X
Cooperative Research and Development Agreements (CRADAs)	X	X		X	X	X		
Technical Assistance Agreements (TAAs)	X					X		
Facility Use/Service Agreements (FUSAs)	X				X	X		
Material Transfer Agreements	X			X		X		
Demonstration/Joint Projects					X	X		X
Patents	X	X		X		X		
Licenses	X	X		X		X		
Other Cooperative Ventures & Agreement Types		X	X	X	X	X		
Web and other mechanisms	X	X	X	X	X	X	X	X

IV. Technology Transfer Agreements

Table 2 provides a summary of new and active technology transfer agreements undertaken within the Department in FY 2012. There were a total of 379 active Cooperative Research and Development Agreements (CRADAs) in FY 2012, of which 284 were newly executed. In addition there were 283 other collaborative R&D arrangements with various parties, including 165 that were new in FY 2012.

Table 2: Collaborative Relationships for Research & Development (FY 2012)

FY 2012	USGS	FWS	BSEE	Reclam-ation	Total
● **CRADAs**, total active in the FY(1)	365	4		10	379
- New, executed in the FY	283	0		1	284
▪ Traditional CRADAs,(2) total active in the FY	17	4		7	28
- New, executed in the FY	5	0		0	5
▪ Non-traditional CRADAs,(3) total active in FY	348	0		3	351
- New, executed in the FY	278	0		1	279
● **Other collaborative R&D relationships**[4]					
▪ (Collaborative Agreements), total active in the FY	275	n/a	8		283
- New, executed in the FY	158	n/a	7		165

CRADA = Cooperative Research and Development Agreement
(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).
(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partner.
(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information. For USGS, Technical Assistance Agreements (TAA) and Facility Use/Service Agreement (FUSA) fit this category.
(4) Based on available data.

Table 3 summarizes invention and patenting activity within the Department during FY 2012 broken out by Bureau. Such activity was limited to USGS and Reclamation. The table indicates that ten new inventions were disclosed, three new patent applications filed and three new patents issued. The corresponding numbers for FY 2011 were five inventions, two applications, and one patent issued.

Table 3: Invention Disclosure and Patenting (FY 2012)

FY2012	USGS	Reclam-ation	Total
● New inventions disclosed in the FY(1)	6	4	10
● Patent applications filed in the FY(2)	2	1	3
● Patents issued in the FY	2	1	3

(1) Inventions arising at the bureau.
(2) Tally includes: U.S. patent applications, foreign patent applications filed on cases for which no U.S. application was filed, divisional applications, and continuation-in-part applications. Excludes: provisional, continuation, duplicate foreign, and Patent Cooperation Treaty (PCT) applications.

Table 4 provides a summary of the number of active licenses managed by Interior bureaus.

Table 4: Active Licenses in FY 2012

	USGS	FWS	Reclam-ation	Total
● **All licenses**, number total active in the FY(1)	20	1	5	26
▫ New, executed in the FY	1	0	0	1

Additional data tables required by OMB Circular A-11 are contained in the Data Appendix to this report. These show that total income in FY 2012 from all licenses amounted to $78,120 (from 24 active licenses).

Table 5 provides a summary of the scope and nature of technology transfer activities and mechanisms that the various bureaus implement currently or might implement in the future.

Table 5: Scope of Activities and Plans Related to the Federal Technology Transfer Act of 1986, by Bureau

Mission	Technology Transfer
United States Geological Survey (USGS). The mission of the USGS is to serve the Nation by providing reliable scientific information to describe and understand the Earth, minimize loss of life and property from natural disasters, manage water, biological, energy, and mineral resources, and enhance and protect our quality of life.	The USGS serves the Nation as an independent fact-finding agency that collects, monitors and analyzes scientific and technical information to provide scientific understanding about natural resource conditions, issues, and problems. The USGS makes this information and knowledge readily available to decision makers and the public. Thus, one of the USGS's main thrusts is broad and open dissemination of its knowledge and information. USGS also pursues technology transfer opportunities under the FTTA and the Stevenson-Wydler Act in a variety of ways.
U.S. Fish & Wildlife Service (FWS). The mission of the U.S. Fish & Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.	FWS Fish Technology Centers were established in 1965 to develop and improve fish culture technology and to provide assistance to Federal and State agencies, Tribes and other nations interested in aquaculture research and solutions. Today there are seven such centers working with industry and government to improve aquaculture opportunities.
Office of Surface Mining Reclamation and Enforcement (OSMRE). OSMRE helps States develop and implement their own approved surface coal mining programs.	OSMRE advances it mission by providing technical assistance based on sound science, and training to its State and tribal partners to enhance their ability to maintain effective programs. Although OSMRE has no formal research and development activities, its Technology Development and Transfer program promotes and disseminates information on techno-logical innovations to better protect the environment during mining and in reclaiming and restoring active and abandoned mines. The program also provides training to ensure that States, Tribes, and OSMRE's other partners continue to administer their surface mining programs efficiently and effectively.
National Park Service (NPS). The National Park Service preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of current and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.	Consistent with the Final Benefits-Sharing Environmental Impact Statement (2009) and the Record of Decision (2010), the National Park Service has drafted benefits-sharing policy and procedures that were reviewed service-wide in 2012. Following public policy review in 2013—and final NPS review and approval—the policy and procedures will be issued. The policy and procedures address benefits-sharing and technology transfer.

Table 5: Scope of Activities and Plans Related to the Federal Technology Transfer Act of 1986, by Bureau

Mission	Technology Transfer
Bureau of Safety and Environmental Enforcement (BSEE). The BSEE works to promote safety, protect the environment, and conserve resources offshore through vigorous regulatory oversight and enforcement.	The BSEE R&D program operates through the Technology Assessment and Research (TA&R) and the Oil Spill Response Research (OSRR) Programs. BSEE research is associated with operational safety, pollution prevention, and oil spill cleanup technology.
Bureau of Reclamation (Reclamation). The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.	Reclamation has the lead Federal responsibility for water management and hydropower in the 17 western States. Its research program is highly applied towards development of solutions that benefit its operations and infrastructure reliability. The research programs use technology transfer fundamentals to help speed field deployment of new innovations.
Bureau of Ocean Energy Management (BOEM). The Bureau of Ocean Energy Management manages the exploration and development of the nation's offshore resources. It seeks to appropriately balance economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.	BOEM's Environmental Studies Program (ESP) develops, conducts and oversees scientific research specifically to inform policy decisions regarding development of Outer Continental Shelf (OCS) energy and mineral resources. Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources and environmental fates and effects.
Bureau of Land Management (BLM). The BLM mission is to sustain the health, diversity, and productivity of America's public lands for the use and enjoyment of present and future generations. The Federal Land Policy and Management Act of 1976 (FLPMA), mandates that BLM manage public land resources for a variety of uses, such as energy development, livestock grazing, recreation, and timber harvesting, while protecting natural, cultural, and historical resources.	BLM's science and technical focus has been on place-based applications to improve the management of public lands in accordance with FLPMA's multiple use mandate. It is exploring technology transfer opportunities that could be employed to help fulfill its multiple use mandate or transfer knowledge, information and technologies to other entities.

Subsequent sections briefly describe each bureau's technology transfer program and a sample of activities in FY 2012. The tabular data requested by OMB Circular A-11 are reported in the Data Appendix, to the extent data are available.

V. U.S. Geological Survey

The United States Geological Survey (USGS) is a scientific bureau within the Department of the Interior whose mission is to serve the Nation by providing reliable scientific information to describe and understand the Earth, minimize loss of life and property from natural disasters, manage water, biological, energy, and mineral resources, and enhance and protect our quality of

life. Under its science strategy outlined in "Facing Tomorrow's Challenges—U.S. Geological Survey Science in the Decade 2007-2017," USGS focuses on the following interdisciplinary mission areas: Ecosystems; Climate and Land Use Change; Energy, Minerals, and Environmental Health; Natural Hazards; Water Resources; Core Science Systems; Administration and Enterprise Information; and Facilities. These mission areas combine expertise from several Earth Science disciplines (e.g. hydrology, geochemistry, biology) working together to address relevant issues of concern to people and other living things on the planet. Organization around these mission areas allows the USGS to better address the needs of customers and partners.

Since delivery of science information is a primary purpose of the bureau, technology transfer activities with the public sector and the private sector, including academia and non-profits, typically support the collection and transference of scientific data (knowledge dissemination). In 2012 U.S. Geological Survey personnel, for example, authored or co-authored over 1900 reports, books, fact sheets, and other publications, including over 900 scientific journal articles. The USGS also cooperates with its public and private collaborators to help them maintain necessary services, better understand the environmental consequences of their commercial and non-commercial activities, and develop new products and services. The USGS has 35 major laboratories and several hundred field offices located around the country.

Within the USGS, technology transfer that extends beyond traditional publications, meetings and conferences and is related to the Stevenson-Wydler Innovation Act and the FTTA is managed through the Office of Policy and Analysis where staff service USGS Science Centers and offices throughout the country. In 2012, the USGS continued negotiating and drafting Cooperative Research and Development Agreements (CRADAs), Technical Assistance Agreements, Facility Use Agreements, Material Transfer Agreements, and Patent Licenses. This office also manages the USGS intellectual property and inventions program; markets USGS technology opportunities and assistance to industry, non-profits, academic institutions, and State agencies; and provides training to USGS personnel on technology transfer and intellectual property protection. At the end of 2012, the USGS had a total of 20 active licenses. During 2012, the U.S. Patent and Trademark Office accepted filings for two new USGS patent applications for: (a) a pore water profiler to obtain a physical and chemical profile of samples of water at different depths, and (b) a method for dechlorinating chlorinated hydrocarbons using microbial mixtures.

USGS science and research contributes to a broad range of valuable collaborative projects in the private and academic sector. Since the implementation of its facility use program in 2003, the USGS has increased to 28 the number of specialty analytical laboratory services providing unique capabilities to U.S., foreign partners and academia. At least 179 user agreements were executed during 2012.

Following are examples of current USGS technology transfer activities:

Improving Earthquake Hazard Assessments. The USGS Earthquake Program, under the auspices of the National Earthquakes Hazards Reduction Program, undertakes a broad range of applied earthquake hazards research, data compilation and archiving, and distribution of earthquake information products and services. The Pacific Gas and Electric Company (PG&E),

a publicly regulated utility providing service within California, is engaged in a long-term, multi-element, action-based seismic risk management program to reduce the impact of future earthquakes on the performance of their gas and electric systems, and to maintain acceptable levels of customer service. To further their programs, PG&E and the USGS have been involved in a series of CRADAs since 1992. The PG&E CRADA, which complements the USGS Earthquake Program, is carried out using the capabilities of five USGS Science Centers (Earthquake, Geology and Geophysics, Pacific Coastal and Marine, California Water, and Geologic Hazards).

The current CRADA is scheduled to run through 2014. PG&E seeks (1) the development and rapid application of data, methods, and technologies that improve earthquake hazard assessments in the regions where its electric power and natural gas facilities, service centers, and office buildings are located and where its customers live and work; and (2) the improvement of emergency response to earthquake occurrence by incorporating real-time earthquake hazard information. In one particular project under the CRADA, the USGS and PG&E produced new geophysical data as part of the Diablo Canyon Power Plant (DCPP) Long Term Seismic Program. Following identification of the Shoreline fault zone offshore the DCPP in 2008, PG&E embarked on a two-year study to more completely evaluate the geologic and seismologic characteristics of the Shoreline fault zone and assess the ground motion hazard at the DCPP. The data and results were reported by PG&E to the U.S. Nuclear Regulatory Commission (NRC) in 2012. The researchers are now performing re-assessments of hazards with the NRC. This project has received many requests from the media for information on earthquake hazards.

A spin-off from this CRADA is a new 2012 initiative led by a team of wildlife biologists and veterinarians from the USGS Western Ecological Research Center to improve our understanding of the ecological impact of high energy seismic studies. Under this initiative, requested by the U.S. Fish and Wildlife Service (FWS), a 3-year study will be undertaken on the effects of high energy seismic experiments offshore on the southern sea otter (Enhydra lutris nereis), a federally-listed threatened species. Sea otters are also crucial indicators of the health of our nearshore waters and coastal resources, from kelp forests to fisheries.

Treating Flesh-Eating Bacteria. The USGS co-owns with Arizona State University an invention relating to synthetic antibacterial compositions having clay-like properties and a method of using these compositions to topically treat skin infections and skin diseases caused by certain types of bacteria, including antibiotic-resistant bacteria. The clay composition kills the bacteria or compromises their ability to grow or reproduce.

Conventional antibiotics have been increasingly ineffective at treating certain bacterial infections of the skin due to resistant bacteria. Past studies have documented the use of natural, medicinal clays in the Ivory Coast for effectively counteracting Buruli ulcers, which are caused by flesh-eating bacteria. This suggests that medicinal clays may provide a means of effectively counteracting skin bacterial infections. While earlier studies indicated that the flesh-eating bacteria succumbed to a type of medicinal clay, specific guidance to identify which clays possess antibacterial properties was lacking, as was an understanding of the mechanism behind the clay's antibacterial activity. The inventors studied many different natural clays and clay minerals to determine factors that make clay toxic to bacteria. Through extensive research, the

inventors identified a reducing agent (pyrite) and the concentration at which, in fine particle form, it renders certain natural clays antibacterial. This invention provides a method for identifying a natural clay having bactericidal activity in its natural form and provides formulations of reducing agents such as pyrite and marcasite and clays to impart a bactericidal effect.

In FY 2012, USGS continued to experiment with clays by taking non-therapeutic clay and making it therapeutic. The therapeutic clay was provided to others for free in exchange for feedback on its efficacy. Anecdotal information suggests that it may be effective for treating horses infected by flesh eating bacteria.

Rapid Mapping and Characterization of Hydrocarbon and Dispersant Plumes in Seawater. The April 2010 Deepwater Horizon oil spill has highlighted the need for tracking undersea hydrocarbon plumes, and understanding their impacts over the long term. Although the well was eventually capped, the impact of this massive spill continues, and will for years to come. Moreover, there have been a number of other, some even larger, well blowouts and oil leaks in the open ocean, e.g., in the Bay of Campeche (in 1979) and the Persian Gulf (in 1991). At present, there is no way to know what remains from these huge pollution events, since divers can rarely descend below 100 meters, and visibility via remotely-operated underwater vehicles is poor. In addition, there are over 6,600 active or removed oil platforms in the Gulf of Mexico alone, and each connects to a huge network of pipelines lying on or just below the seafloor. Many of them are old, corroded, or damaged by hurricanes, and are known to be leaking. To protect coastline and marine environments, new technologies are needed to detect, map, and characterize undersea hydrocarbon plumes, and to predict their movements.

The USGS owns an invention that tracks undersea hydrocarbon plumes by using oil's ability to serve as a dielectric insulator. A voltage applied across a dielectric insulator induces a charge in the latter. The magnitude of this charge depends on the "capacitance" of the dielectric. [The capacitance is a measure of the electrical charge that can be induced per volt applied.] A mixture of seawater and oil also serves as a dielectric. The greater the dispersal of the hydrocarbons in the seawater the greater the induced charge. An oscillating voltage signal in polluted seawater causes a varying response whose frequency depends on the size and density of the oil droplets.

The measurement device consists of a towed electrical transmitter-sensor streamer array having three or more streamer cables that is pulled through the water column at three or more depths to detect hydrocarbons in the seawater column by measuring seawater capacitance. This permits immediate development of detailed maps measuring seawater capacitance, such that hydrocarbon plumes in seawater can be mapped and characterized, including their location and movement, for better environmental control and management.

In FY 2012, the CRADA was amended to add tasks for conducting field trials following successful laboratory studies that indicate that variations of this method can be used to efficiently map hydrocarbon plumes in 3-D in the deep ocean.

Borehole Geophysical Logging for Ground and Surface Water Monitoring of an Ecologically Sensitive Aquifer. In 2010, the USGS Fort Lauderdale Water Science Center

entered into a Technical Assistance Agreement (TAA) with Florida Power & Light Company (FPL) to collaborate on a study of salinity intrusion into groundwater at FPL's Turkey Point Nuclear Plant in southeastern Florida. This power plant uses a recirculating cooling system. The salinity of the cooling water is greater than natural groundwater salinities in the highly permeable carbonate Biscayne aquifer located in the area. Aquifers in terrain with landforms and hydrology created from the dissolution of soluble rocks, also known as karst aquifers, are highly vulnerable to contamination due to the hydrogeology of the landscape. In the U.S., about 40% of the groundwater used for drinking comes from such aquifers.

Building on work done over the previous two years,[1] in FY 2012, USGS researchers produced data and prepared multiple publications that have added to the scientific base of knowledge regarding the interaction between surface water with elevated salinities and fresh groundwater in a karst carbonate aquifer. This knowledge should help monitor, design and plan for the future construction of closed-loop cooling-canal system facilities for power plants. Data has been provided and numerous meetings have been held with stakeholders and local State and county regulators. These organizations included the South Florida Water Management District, Miami Dade Department of Planning, Environment and Regulatory Affairs and the Biscayne National Park. The Nuclear Regulatory Commission (NRC) has also been a participating entity in the project this past year. Next steps for this project are currently under discussion by the collaborators.

Study of Juvenile Lampreys. The lamprey species is an important link in the foodweb of the Columbia River Watershed. The lamprey is also considered as one of the First Foods, which the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) deem to be the minimum ecological products necessary to sustain their culture. The CTUIR, a federally recognized Indian Tribe acting through its Department of Natural Resources Fisheries Program, entered into a Technical Assistance Agreement with the Columbia River Research Laboratory, USGS Western Fisheries Research Center, to study how well various types of irrigation diversion screens work for the safe and effective passage of juvenile lampreys.

Despite several species of lampreys being petitioned for protection under the Endangered Species Act in 2003, and continued population declines of Pacific lampreys, little is known about the effects of fish screens on juvenile lampreys. Developing hydraulic and design criteria specific for juvenile lampreys and understanding the effects of current screen types on lamprey populations would be an important step towards their recovery, and toward maintaining the culture of the CTUIR.

In FY 2012, results of the first phase of the research effort were published, including initial results on the effects of modifications to screen types on lamprey populations.

Studies on Protecting the Kootenai River White Sturgeon. The Kootenai River white sturgeon (Acipenser transmontanus) is one of 18 land locked populations of white sturgeon that occur in western North America. Kootenai River white sturgeon (KRWS) occurs in Idaho, Montana and British Columbia, Canada. Sturgeons have remained essentially unchanged since

[1] Department of the Interior, FY 2011 Annual Report on Technology Transfer.

the time of the dinosaurs and can live to be 100 years old. The sturgeon is an endangered species because the population is waning. The wild population consists of an aging cohort of large old fish and young fish which have a high mortality level. The recent years of successful spawning by Kootenai River white sturgeon in the river between Kootenai Lake and Libby Dam should have resulted in increased numbers of juveniles but few juveniles have been detected.

The Kootenai Indian Tribe of Idaho has tribal lands that encompass the Kootenai drainage basin, a critical habitat for the fish. The Tribe and the USGS Western Fisheries Research Center Columbia River Research Laboratory in Cook, WA and the USGS Leetown Science Center, S.O. Conte Anadromous Fish Research Laboratory have been working together for several years under the authority of two Technical Assistance Agreements to develop studies focused on protecting the Kootenai River white sturgeon. The current projects are multi-year, multi-phase projects with studies that include developing information about the early life stages, feeding behaviors, wintering, foraging and rearing and holding procedures for the species. As part of the next stage of work associated with this project, a distinguished Technical Advisory Team was convened in FY 2012 to proceed with project actions and plans to help protect the Kootenai River white sturgeon.

VI. U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (FWS) is dedicated to the conservation, protection, and enhancement of fish, wildlife and plants, and their habitats. The FWS is the only agency in the Federal Government whose primary responsibility is management of fish and wildlife resources for the American public. The FWS also helps ensure a healthy environment for people by providing opportunities for Americans to enjoy the outdoors and our shared natural heritage. The agency manages the 96 million acre National Wildlife Refuge System, which receives over 40 million visitors each year who participate in hunting, fishing, wildlife observation and photography, environmental education and interpretation, and other outdoor recreation activities. The FWS also operates 70 National Fish Hatcheries which, in conjunction with Fish Health Centers and Fish Technology Centers, restore native aquatic populations, mitigate for fisheries lost as a result of Federal water projects, and support recreational fisheries throughout the United States.

FWS's Research and Development (R&D) is primarily focused on providing the basis for effective conservation in order to meet its mission of working with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The majority of FWS's technology advancements are transferred through public dissemination. FWS employees are actively involved in the larger scientific community, including participating in scientific societies, attending and presenting at meetings and conferences, and generating and publishing original research. For example, in FY 2012, FWS personnel published over 400 articles in peer reviewed science journals. The agency follows a partnership-based approach to stewardship in order to leverage resources to meet challenges and combine strengths to better accomplish its mission. FWS partnerships with universities, local municipalities, private landowners, corporations and numerous other interests are important

because the natural resource problems that it seeks to solve transcend disciplinary and geographic boundaries and jurisdictions.

The agency's primary research nexus with the private sector centers on the Fisheries Program and the science network consisting of nine Fish Health Centers, six Fish Technology Centers, the Conservation Genetics Laboratory, and the Aquatic Animal Drug Approval Program. These centers provide assistance and support to its conservation partners which include Federal, State, tribal, and non-government organizations covering a broad range of disciplines including biostatistics, population ecology, genetics, nutrition, and internationally recognized research on fish diseases and pathogens of fish and other aquatic organisms. FWS research entities provide leadership in science and technology, especially for restoration and recovery of native species. With a focus on rapid turn-around applied science, these centers assist fish and wildlife managers with problem solving and new methods for meeting restoration goals and objectives.

The transfer of FWS's technology and knowledge to the public and collaborators accelerates the adoption and use of agency research while improving the economic and societal impact from its R&D investments and helping solve natural resource related problems. For example, FWS works closely with the aquaculture feed industry in developing sustainable feed options utilizing plant-based ingredients and in refining understanding of species' nutritional needs while minimizing waste. FWS also uses its research to help inform a wide range of wildlife management decisions in the interest of the general public. For instance, the National Wildlife Refuge Inventory and Monitoring Program regularly monitors a range of biological data about the status, trends and responses to management of species and habitats within the Refuge System, in order to inform and improve management of natural resources.

Within the FWS, the technology transfer function is shared between individual FWS programs and the Division of Policy and Directives Management (PDM), with support from the Office of the Solicitor and the Office of the Science Advisor. While the vast majority of FWS's technology transfer is done via public dissemination through traditional avenues such as peer reviewed papers, reports and fact sheets, the FWS has been issued four patents since 1998. For example, a patent was awarded in 2005 for calcein detection devices developed at the Northeast Fishery Center in Lamar, PA, to non-lethally mark and detect hatchery-reared Atlantic salmon for up to three years of age post-marking. Western Chemical of Ferndale, WA, was granted an exclusive license for the invention for a period of eight years. Other inventions include a rocker for refrigerated storage or transport of fish sperm, a fistula device to gather eggs from inside a fish, and a method for agglomerating fine powders for larval aquatic feed. The FWS did not submit any new filings for patent applications in 2012.

The FWS Aquatic Animal Drug Approval Program under the Fisheries and Aquatic Resource Conservation program, currently has four CRADAs in place. These agreements — with Merck Animal Health, Summit, NJ; Aquatic Life Sciences, Ferndale, WA; Frontier Scientific, Logan, UT; and PennField Animal Health, Omaha, NE — permit the parties to identify research opportunities that support development of new aquatic animal drugs, broaden the U.S. technology base, and support accomplishment of FWS scientific mission objectives. New aquatic animal drug approvals are critically needed to maintain the health and fitness of aquatic species in a world where challenges are constantly evolving, and to provide similar benefit to

both public and private sector aquaculture programs throughout the U.S. For example, the CRADA with Merck Animal Health has been instrumental in the 2012 approval of Aqualflor (florfenicol) for use to control mortality caused by bacterial pathogens in catfish and freshwater-reared salmonids. Aquaflor is the first new oral antibacterial approved for use in fish in over 20 years.

Following are other examples of ongoing activities related to technology transfer.

Fish Technology Centers. Fish Technology Centers were established in 1965 to develop and improve fish culture technology and provide assistance and advice on fish culture to National Fish Hatcheries, other Federal and State agencies, Tribes, other Nations, and the aquaculture industry. The Fish Technology Centers developed culture techniques and fish diets now used around the world, including the dry, long-lasting feeds that revolutionized the fish-rearing industry. Technology developed by Fish Technology Centers provided the foundation of the aquaculture industry, which contributes millions of dollars annually to the U.S. economy. This work continues today, but with a focus on sustainable feeds that minimize waste and reduce reliance on ocean forage fish as a protein source in feeds.

In addition to the nutrition program, Fish Technology Centers conduct programs in genetics, population dynamics, and ecological physiology. Applied research on priority issues, such as climate change, focuses on effects of water temperature and other factors on reproduction, growth, and survival. Genetic studies at the population and landscape levels provide critical information for fish and wildlife management decisions. For example, in Montana, the FWS is working with AVISTA Power Corporation, the States of Idaho and Montana, and several tribal partners to develop a suite of DNA markers to genetically identify the origin of bull trout and assist with the selective passage of bull trout over three dams in the Clark Fork River Basin.

Models are also developed to predict population responses to various management actions. For example, scientists at Lamar and Bozeman FTC (MT) are studying climate change implications for the distribution of lake trout in the Great Lakes and developing refined bioenergetics models. Accurate predictions of changes in growth and habitat suitability of these species on a landscape level is necessary to prioritize areas for protection, based on the potential of these species for adaptation under various climate change scenarios in the future.

Fish Health Centers. The FWS's Fish Health Centers play an integrated role in applied science and technical transfer. Their scientists are leaders both nationally and internationally in the diagnosis of wildlife diseases and in the science of aquatic animal health, developing and validating tests that benefit, and are adopted by, the aquaculture industry. Fish Health Centers work closely with Federal, State, tribal, academic and NGO partners in efforts to further the management and science of fisheries and aquaculture in general and wildlife pathogens in particular.

Aquatic Invasive Species: The FWS Aquatic Invasive Species program works to prevent introductions of potentially harmful species and to develop early detection and rapid response capabilities. For example, through the Great Lakes Restoration Initiative (GLRI), the FWS is partnering with the University of Notre Dame to develop a surveillance program for invasive

species at risk of invading the Great Lakes. This technology uses suspended DNA in the aquatic environment (environmental DNA or eDNA) to confirm the presence of organisms such as Asian carp present in low numbers and possibly "invisible" to traditional sampling methods. This new and innovative technology should be expected to significantly benefit both FWS programs and partners by allowing earlier detections of invasive species.

VII. Office of Surface Mining Reclamation and Enforcement

One of the purposes of the Surface Mining Control and Reclamation Act of 1977 (SMCRA) is to help States develop and implement their own approved surface coal mining programs. The Office of Surface Mining Reclamation and Enforcement (OSMRE) achieves this in part by providing technical assistance based on sound science, and training to its State and tribal partners to enhance their ability to maintain effective programs.

Although OSMRE has no formal research and development activities, its Technology Development and Transfer program promotes and disseminates information on technological innovations to better protect the environment during mining and in reclaiming and restoring active and abandoned mines. The program also provides training to ensure that States, Tribes, and the bureau's other partners continue to administer their surface mining programs efficiently and effectively.

The principles that underlie OSMRE's Technology Development and Transfer program include: (a) increasing the technical knowledge of the reclamation of active and abandoned coal mines; (b) developing and enhancing working relationships among the bureau's partners in Federal, State, and tribal governments, and in industry and academia; and (c) leveraging its resources through partnerships.

OSMRE's delivery of specialized training courses illustrates these principles in action. The bureau's National Technical Training Program (NTTP) and Technical Innovation and Professional Services (TIPS) has acquired a reputation for offering high-quality training that helps its partners administer their surface coal mining programs.

Established in 1985, NTTP is an ongoing educational program designed to aid the bureau's mission by increasing the technical competence and professionalism of State, tribal, and OSMRE regulatory and reclamation staff. The program's instructors write the curriculum and then present courses in a variety of highly technical fields. This technical training also provides participants with a common understanding of the regulations, advances in science and technology, and how to apply them, while also interacting with stakeholders: the public, the industry, and other governmental agencies.

Similarly, TIPS provides specialized hardware, scientific software, customized software training, and technical assistance to its user community. This program, as with the NTTP, helps strengthen the capabilities of States, Tribes, and bureau staff to enforce SMCRA through high-quality technical expertise and assistance, scientific information, and training.

What follows are some of OSMRE's Technology Development and Transfer program accomplishments during FY 2012.

National Technical Training Program's Fiscal Year 2012 Program Accomplishments. In Fiscal Year 2012, NTTP trained 973 students from 43 State, OSMRE and tribal programs. It offered 45 training sessions covering 39 technical, legal, and programmatic subjects ranging from best practices and technologies to protect society and the environment from the adverse effects of surface and underground mining to methods to restore land use capabilities. The course subjects are, where appropriate, tailored to conditions and characteristics specific to each mining region, and offered in or near those regions. Course subjects include a wide variety of technical areas including proper inspection tools and techniques, soils and revegetation, identification and handling of acid/toxic forming materials, water quality assessment, legal aspects of enforcement procedures, and preparation of evidence and testimony.

The entire program—from identification of training needs through course development and presentation—are cooperative efforts between State, tribal, and OSMRE offices. Course instructors are primarily volunteers from about 43 State, tribal, and OSMRE offices. These partner instructors participated in course instruction, development, and content revisions. NTTP instructors keep abreast of changing technologies, evolving methodologies and policies to ensure the training reflects the best protection and land restoration practices.

Overall the program achieved an effectiveness rating of 95 percent, based on the students and their supervisor's response to how useful the training will be in their current position.

Technical Innovation and Professional Services. The Technical Innovation and Professional Services (TIPS) Training Program is a collaborative effort among OSMRE, States, and Tribes to ensure that all agencies with Surface Mining Act responsibilities have access to, and are trained in, the same advanced software and hardware tools to implement the Act. The program maintains specialized training centers in the bureau's regional offices in Denver, Colorado; Alton, Illinois; and Pittsburgh, Pennsylvania.

Although most tools used in the training program are off-the-shelf applications, training is tailored exclusively to mining and reclamation uses. Such training is not found elsewhere. In 2012, the training program received a customer satisfaction rating of 96% percent. Eighteen instructor-led classes were held in 2012 with 373 students completing class sessions.

In addition to instructor-led courses, the training program makes 130 e-learning courses available through DOI Learn, a learning-management system offered by the Interior Department, and Environmental Systems Research Institute (ESRI), a world leader in GIS modeling and mapping. E-learning provides flexibility, convenience and cost savings to its users.

The TIPS program works in cooperation with NTTP. It complements training the latter provides in SMCRA fundamentals and scientific principles with the training necessary for the use of TIPS technology.

Information on this program (and NTTP) is available at www.tips.osmre.gov. This website provides details about current training classes, descriptions of—and access to—digital data files for public-domain TIPS software, and a comprehensive link to nationwide geospatial data sources.

The following two examples are representative of the numerous OSMRE activities that took place under this program in FY 2012.

GeoMine. The GeoMine Pilot Project is exploring the feasibility of producing a web-based geospatial map of active, idled or reclaimed mine areas in the United States. The pilot-project phase begins with the mines in four Appalachian States — Virginia, West Virginia, Tennessee, and Kentucky. In addition to the four State programs and OSMRE, contributing partners in this project include the EPA, Corps of Engineers, and the FWS. The interagency team is now in the process of drafting a final report. To date GeoMine has digitized geographic data on 71,000 SMCRA boundaries in the four pilot States.[2] The GeoMine Pilot Project was selected by the Federal Geographic Data Committee for national recognition as one of ten Federal projects to be included in the Administration's GeoCloud II demonstration project.

Adams State University Memorandum of Understanding (MOU). Through the Minority Higher Education Program initiative, TIPS took the lead in developing an MOU with Adams State University (ASU), a Hispanic Serving Institution in Alamosa, Colorado. This MOU, signed by the President of the University and OSMRE's Director on August 23, 2012, formally recognizes a partnership to share educational services to benefit both the University and OSMRE by developing e-Learning courses in TIPS and NTTP and advancing ASU's education curricula. The MOU also furthers the Secretary of the Interior's youth outreach initiative. Detailed plans to meet shared goals are now underway for 2013 and 2014.

Applied Science Program. Each year OSMRE's Applied Science program selects and funds applied science proposals that seek to improve on-the-ground reclamation and develop solutions to environmental concerns associated with coal mining. The Nation needs these continuing efforts to better protect identified endangered species, improve reforestation and revegetation, protect prime farmland, improve technologies to mitigate acid mine drainage, improve methods for locating underground mines, and to address other problems resulting from the adverse effects of coal mining that may threaten the public or the environment. Selection criteria include the need to bring better information, technology, and tools to the States and Tribes, the coal-mining industry, and to non-profit watershed and community groups. Projects and institutions funded in FY 2012 include:

- Evaluation of Geomorphic Reclamation Performance and Models in the Southwestern United States (University of New Mexico)**.** This project will scrutinize the success or failure of geomorphic reclamation efforts in the southwest. Geomorphic reclamation is the application of principles and insights gained from the study of geomorphology (landforms) via land modification and reclamation. These landforms blend in with the natural surroundings. This technique is expected to result in stable landforms that require little maintenance.

[2] "SMCRA boundaries" are boundaries delineated in a mine's permit.

- Assessing Geomorphic Reclamation in Valley Fill Design (West Virginia University). This project will explore the post-construction effectiveness of geomorphic reclamation.
- Low-cost, Green Technology to Improve Water Quality in Mining-Impacted Ecosystems: Model Development and Optimization (Southern Illinois University). This project will evaluate new techniques to mitigate acid mine drainage, and their cost effectiveness.

VIII. National Park Service

As part of its mission, the National Park Service (NPS) actively manages the natural, cultural and historical resources entrusted to it. This includes preserving and maintaining these resources and, where necessary, mitigating any impairment or restoring these resources. The vast majority of these activities are undertaken at the level of each individual park unit.

Scientific activities within NPS focus on improving the understanding and management of park natural and cultural resources, and in cooperation with partners, preserving and interpreting similar resources outside parks. The information generated by these activities is shared with park managers and stakeholders, including public and private land managers, as well as the broader public, largely through interpretive programs, exhibits, conferences, meetings, training, and standard publication media, such as reports, newspapers, journals, magazines, fact sheets, and webpage postings.

In order to expand the range of expertise and tools available to it, NPS participates in many collaborative ventures with universities, and other governmental and non-governmental organizations, including the Cooperative Ecosystem Studies Unit Network.

The NPS Cultural Programs include the National Center for Preservation Technology and Training (NCPTT), which was created by Congress to fill a fundamental need for research and technology transfer among Federal, State, and local historic preservation programs. NCPTT serves as a research and development laboratory for historic preservation and advances the application of science and technology to preservation problems. The National Center also supports applied research, partners with professional and scientific organizations, publishes technical guidance for preservation professionals, and trains students and practitioners in the latest preservation techniques.

The NPS also encourages qualified scientists to undertake research on park physical, biological and other resources under the egis of park Scientific Research and Collecting Permits. Such permits are issued for scientific and educational purposes only. The specimens and components of specimens may not be used for commercial or other revenue-generating purposes. Research results derived from collected specimens may not be used for commercial or other revenue-generating purposes unless the permittee has entered into an approved benefits-sharing agreement with NPS. In accordance with the National Parks Omnibus Management Act of 1998, which authorizes the Secretary of the Interior to enter into negotiations with the research community and private industry for equitable, efficient benefits-sharing arrangements, NPS is developing policy and procedures to implement benefits sharing. For each benefits-sharing agreement, NPS proposes to choose an applicable agreement type from among several available

authorities. The Cooperative Research and Development Agreement (CRADA), authorized by the FTTA, is one such option. NPS released the draft benefits-sharing policy for public review in December 2012.

IX. Bureau of Reclamation

The Bureau of Reclamation (Reclamation) is a water management agency whose mission is to help provide water and power to the 17 Western States and numerous Tribes while protecting the environment and the public's investment in the infrastructure it has constructed and operates. It is the largest wholesaler of water in the country. It brings water to 31 million people, and to one out of five Western farmers, who produce 60% of the nation's vegetables and 25% of its fruit and nut crop. Reclamation is the second largest producer of hydroelectric power in the western United States. Its 53 power plants annually provide more than 40 billion kilowatt hours of electricity, enough to power 6 million homes, generating $1 billion in revenues.

Reclamation R&D – Reclamation's R&D is primarily focused on applications to identify and develop solutions related to the broad spectrum of water and hydropower related issues. Reclamation conducts both programmatic and project-specific R&D. Programmatic R&D is managed by Reclamation's R&D Office and funded through the Science and Technology Program. Science and Technology Program projects are competitively selected based on the ability to meet priority needs that have broad application across Reclamation and the West. Project-specific research is typically driven by the necessity to improve solutions and processes at a particular Reclamation facility or project, and is done as part of the technical studies and engineering work associated with operating, updating, and maintaining a specific Reclamation facility or project operational responsibility. In either case, expert Reclamation engineers and scientists typically lead or are heavily involved in the effort.

Reclamation Collaborative R&D Activities – Management of water resources is a shared responsibility across Federal, State, and local agencies and the water user organizations. Collectively, these organizations possess a broad range of scientific and technical expertise and managerial perspectives that drive research used to inform decisions, produce solutions to real world problems and increase operational efficiency. Universities and non-governmental organizations also possess cutting edge technical and scientific expertise that can augment Reclamation's R&D activities. Collaborative endeavors are, thus, central to Reclamation R&D activities. Accordingly, Reclamation dedicates significant resources to foster and, where appropriate, lead collaborative R&D endeavors in order to bring together complementary capabilities, leverage resources, and avoid duplication of effort. The majority of these cooperative activities does not involve the need to protect intellectual property or exchange funds between parties, but instead involve cooperation without the need for formal agreements or use of authorities provided by the Federal Technology Transfer Act. In addition, cooperation involving the exchange of funds or a formal commitment of resources can be achieved via other non-FTTA related formal agreements (e.g., interagency agreements, cooperative agreements, and procurement contracts) authorized by other statutes.

Reclamation Technology Transfer – Although Reclamation's R&D focus is on water issues specific to the arid and variable climates characteristic of the Western U.S., the new solutions, tools, and information developed can have broad applicability regardless of location. Accordingly, the transfer of Reclamation's technology and knowledge across the national and international communities of practice maximizes public benefits of Reclamation's R&D investments.

The majority of Reclamation's technology advancements are transferred through public dissemination, while others require the capabilities and know-how of the private sector to mature, mass produce and otherwise commercialize the technology into market-ready products. Reclamation's research nexus with industry is typically in the area of hydroelectric power generation, water infrastructure, water conservation, and desalination/water purification technologies.

If an industry partner is needed to ultimately transfer the technology into a market-ready product, Reclamation utilizes the authorities available under Federal technology transfer legislation to protect intellectual property, as needed, and form research and licensing partnerships with U.S. manufacturing industries. Reclamation's R&D Office implements these authorities on behalf of Reclamation. It also serves as a surrogate for an Office of Research and Technology Applications (ORTA) as required by 15 USC 3710(b). The R&D Office also utilizes a funded interagency agreement with the USDA Agricultural Research Service (ARS) Office of Technology Transfer to have access to the full range of expert skills needed to implement technology transfer authorities (e.g. experienced technology transfer specialists, patent advisors, license specialists, CRADA specialists,) on a project-by-project basis. This arrangement benefits the government since it avoids the need to build similar capabilities within Reclamation or the Department. In FY 2011, Reclamation also began utilizing partnership intermediaries as authorized by 15 USC 3715, to facilitate and broker research partnerships with industry via its interagency agreement with USDA-ARS.

Consistent with the October 28, 2011, Presidential Memorandum on *Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Business*, Reclamation is exploring new ways to better engage U.S. industry at the early stages of Federal discovery. This would allow the commercial value for such discoveries to be identified early in the research process, and foster industry partnerships to more effectively and rapidly pull the technology forward in order to fulfill Reclamation's mission while more widely disseminating the resulting technologies. In addition, Reclamation also plans to create more awareness across U.S. industries and other non-government organizations about the specialized research resources (people, lands, and facilities) that they can access through technology transfer agreements authorized by 15 USC 3710a. In addition to physical research laboratories, Reclamation's R&D assets include engineering and scientific expertise, and extensive water storage, water delivery and hydropower facilities that offer unsurpassed real-world laboratories for field tests, evaluations, and demonstrations of new technologies and processes related to water and hydropower. Because the majority of Reclamation R&D activities do not involve technology development that requires patents or industry involvement to mature the technologies into viable products, the technology transfer activities that Reclamation conducts under the authorities of the Federal Technology Transfer Act are a minor, but important subset of Reclamation technology

transfer responsibilities. Examples of the projects authorized under the Federal Technology Transfer Act that were active during 2012 are summarized below.

Water Purification Technologies. Ensuring access to the quantity and quality of water needed to support growing economies, societies, and overall quality of life is a national and international challenge. New and improved desalination technologies are central to meeting this challenge. U.S. industries are currently world leaders in manufacturing desalination technologies. Desalination technologies are not only tools to convert seawater into useable waters, but also to treat traditional and non-traditional sources of inland waters for a variety of uses. Pooling the know-how and research capacity of Federal and U.S. private sector companies is vital to maintaining and growing the U.S.'s world-wide leadership position in this vital area, and meeting the growing needs for water in the U.S. and abroad.

During 2012, Reclamation entered into a Material Transfer Agreement (MTA) with Dow Chemical Company (Dow) to evaluate Reclamation's recently patented desalination membrane to purify water while resisting chlorine degradation. A significant deficiency of industry-standard desalination membranes is their poor ability to resist chlorine degradation. This is important because chlorine dosing is vital to the water treatment process in order to prevent membrane biofouling. Chlorine is also commonly found in the water that has to be treated by desalination membranes.

Under the agreement, Reclamation provided Dow with its patented chemical membrane formulation to manufacture a set of full-scale membranes for prototype testing. Dow provided their manufacturing know-how and capability to scale-up the Reclamation formulation into the full size membranes and also provided a set of the current Dow industry-standard membranes for comparison testing. The membranes were tested by Reclamation at Reclamation's Yuma Area Office-Water Quality Improvement Center. Results indicate the new Reclamation formulation performed well, but did not exceed that of the Dow industry standard. The patented Reclamation formulation has many derivations and patent applications for additional new formulations were filed by Reclamation during 2012. Reclamation and Dow are now considering an expanded collaborative agreement to jointly evaluate and test a broader spectrum of Reclamation's formulations. If formulations are found to perform significantly better than current industry standards, subsequent collaborative activities would be pursued to mature the formulation(s) into commercially available membranes.

Controlling Invasive Mussels. Starting in 2009, Reclamation partnered with Marrone Bio Innovations (MBI) under a Cooperative Research and Development agreement (CRADA) to test and improve Marrone's molluscicide — Zequanox® — a biopesticide product made from a dead, naturally occurring soil microbe called *Pseudomonas fluorescen.* Controlling quagga mussels that have recently invaded the Colorado River and other western water bodies is a high priority for Reclamation and other Western water managers. These mussels have clogged many closed-system water delivery and cooling systems across the network of Reclamation and other western water storage and delivery infrastructure. Under the CRADA, MBI funded Reclamation to help test multiple formulations of Zequanox in closed water systems at Davis Dam on the Colorado River during FY2012. The CRADA objective was to fine-tune product formulations, delivery systems, and application rates under prototype field conditions to accelerate the

development of a commercial product that could be transferred and deployed across typical water infrastructure and operational settings. Reclamation's CRADA contributions included the use of facilities, and expert assistance from Reclamation's quagga mussel research team to collaborate with the MBI research staff.

In FY 2012, the U.S. Environmental Protection Agency (EPA) approved a dry formulation of Zequanox® under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as an EPA registered biological product for controlling invasive mussels within enclosed systems and infrastructures (registration number 84059-15). The objective of FIFRA is to provide Federal control of pesticide distribution, sale, and use. All pesticides used in the United States must be registered by EPA. Registration assures that pesticides will be properly labeled and that, if used in accordance with specifications, they will not cause unreasonable harm to the environment. Use of each registered pesticide must be consistent with use directions contained in any labeling.

X. Bureau of Safety and Environmental Enforcement

The Bureau of Safety and Environmental Enforcement (BSEE) works to promote safety, protect the environment, and conserve resources offshore through vigorous regulatory oversight and enforcement.

Within BSEE, the Offshore Regulatory Program develops standards and regulations to enhance operational safety and environmental protection for the exploration and development of offshore oil and natural gas on the U.S. Outer Continental Shelf (OCS).

The Oil Spill Response division is responsible for developing standards and guidelines for offshore operators' Oil Spill Response Plans (OSRP) through internal and external reviews of industry OSRPs to ensure compliance with regulatory requirements and coordination of oil spill drill activities. It also plays a critical role in the review and creation of policy, guidance, direction and oversight of activities related to the agency's oil spill response. The division oversees the Unannounced Oil Spill Drill program and works closely with sister agencies such as the U.S. Coast Guard and Environmental Protection Agency to continually enhance response technologies and capabilities.

BSEE operates the National Offshore Training and Learning Center (NOTLC) with specially developed curriculum focusing on keeping our experienced inspectors current on new technologies and processes and ensuring that our new inspectors are given the proper foundation for carrying out their duties rigorously and effectively. The NOTLC works cooperatively with industry and academia to provide the specialized training needed. The bureau also operates the Oil and Hazardous Materials Simulated Environmental Test Tank (Ohmsett) in Leonardo, N.J., which serves as the National Oil Spill Response Research and Renewable Energy Test Facility. Ohmsett is available for use by industry and government.

BSEE R&D operates through the Technology Assessment and Research (TA&R) and the Oil Spill Response Research (OSRR) programs. The former supports research associated with operational safety and pollution prevention (including renewable energy). It was established in

the 1970s to ensure that industry operations on the Outer Continental Shelf incorporated the use of the Best Available and Safest Technologies (BAST) subsequently required through the 1978 OCSLA amendments and Energy Policy Act of 2005. The OSRR program was established through the Oil Pollution Act of 1990 to research oil spill response technology. Its Ohmsett facility is available to provide independent and objective performance testing of full-scale oil spill response equipment and marine renewable energy devices, and improving technologies through research and development.

BSEE's R&D focus is on offshore operational oil/gas and renewable energy issues. The majority of the Bureau's technology advancements are transferred through public dissemination. BSEE's primary research synergy is with international government organizations and the oil/gas and renewable energy industry. It is typically in the area of ensuring that the best available and safest technology is used in the US Outer Continental Shelf. Additional information and research deliverables are available at: http://www.bsee.gov/Research-and-Training/Technology-Assessment-and-Research.aspx.

BSEE is also a member of the International Committee on Regulatory Authority Research and Development (ICRARD), which focuses on transferring knowledge worldwide between governmental entities in the area of health, safety and environment in the petroleum sector. Although membership is only available to government entities, ICRARD cooperates with industry to coordinate and transfer technology.

Following are examples of technology transfer activities undertaken in FY 2012.

Best Available and Safest Technology. BSEE is developing a program to identify and ensure the deployment of Best Available and Safest Technology (BAST) for use in offshore facilities. As part of this exercise, in FY 2012, BSEE entered into an agreement with Argonne National Labs (ANL) under which the latter would provide its engineering expertise to establish test and laboratory facilities, protocols and methodologies to identify and evaluate BAST.

Freeze-Up Study of the Alaska Beaufort and Chukchi Seas. BSEE entered into a shared agreement with researchers from industry to advance understanding of conditions and formation of Arctic ice in the Beaufort and Chukchi Seas offshore Alaska. Greater knowledge of the freeze-up season would advance the safety, and limit the environmental impacts, of exploration drilling operations and development of offshore oil and gas prospects in the Beaufort and Chukchi Seas. The focus of this study includes a better understanding of the freeze-up processes that exert a significant impact on the design, construction, and operation of coastal and offshore structures; occurrence and dynamics of large ice movement events in response to storms; and the development and extent of the landfast ice zone.

Bathymetric Survey at Site of Grounded Ice Feature in Chuckchi Sea. In FY 2012, BSEE entered into a joint industry project with scientists from industry which will provide a rare opportunity to observe and collect data from a known multi-year ice incursion event. The information gathered from this exercise should help BSEE better understand the geological, meteorological and other factors governing ice incursion and its consequences on the sea bottom.

Such information can be invaluable in developing criteria for siting, constructing and burying pipelines in the OCS.

XI. Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management (BOEM) manages the exploration and development of the Nation's offshore resources. It seeks to appropriately balance economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.

It is responsible for the development of the Five Year Outer Continental Shelf (OCS) Oil and Natural Gas Leasing Program and assessments of the potential of oil, gas and other mineral resources, and renewable energy in the OCS. It develops inventories of reserves of these resources and develops production projections, and conducts economic evaluations to ensure that U.S. taxpayers get fair market value for OCS leases.

BOEM handles the actual lease sales, grants and agreements in the OCS for the exploration and/or development of minerals and renewable and non-renewable energy. It also develops official maps and GIS data for the OCS.

BOEM's Office of Environmental Programs conducts environmental reviews, including *National Environmental Policy Act* (NEPA) analyses and compliance documents for each major stage of energy development planning. These analyses inform the bureau's decisions on the Five Year Program, and conventional and renewable energy leasing and development activities. Additionally, BOEM's scientists conduct and oversee environmental studies to inform policy decisions relating to the management of energy and marine mineral resources on the OCS through its Environmental Studies Program. BOEM has three regional offices in New Orleans, Louisiana, Camarillo, California, and Anchorage, Alaska, that manage oil and gas resource evaluations, environmental studies and assessments, and leasing activities, including the review of Exploration Plans and Development Operations and Coordination Documents, fair market value determinations, and geological and geophysical permitting.

BOEM Science. The BOEM's Environmental Studies Program (ESP) plans, conducts and oversees world-class scientific research to inform policy decisions regarding leasing and development of OCS energy and mineral resources. BOEM works to manage the exploration and development of the Nation's offshore resources in a way that appropriately balances economic growth, energy development, and environmental protection through oil and gas leases, renewable energy development, and environmental reviews and studies.

BOEM's environmental studies cover a broad range of disciplines including physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources and the environmental effects of energy development. BOEM is a leading contributor to the growing body of scientific knowledge about the nation's marine and coastal environment.

BOEM oversees scientific research conducted through contracts, cooperative agreements with State institutions or universities and interagency agreements. These arrangements enable the bureau to leverage resources, meet national priorities and satisfy common needs for robust scientific information. Many of the bureau's studies are collaborations with partners under the umbrella of the National Oceanographic Partnership Program.

BOEM Technology Transfer. BOEM's technology transfer activities include dissemination of information, knowledge and technologies to the various regions, and to commercial entities and other stakeholders with interests in the OCS.

Studies that have been undertaken by or through funding from BOEM are available to the public through the Environmental Studies Program Information System (ESPIS), and technical summaries of more than 700 BOEM-sponsored environmental research projects, as well as copies of more than 2,000 research reports, are available for online full text search. To learn more about BOEM's ongoing work to further environmental studies, go to: http://www.boem.gov/studies.

BOEM's Environmental Studies Program typically conducts or supports approximately 10 scientific meetings, Information Transfer Meetings, symposia, and its Federal Advisory Act Committee meetings (OCS Scientific Committee). BOEM funded research has also supported and directly led to the publication of hundreds of peer-reviewed scientific articles and masters, doctoral students and post-doctoral fellows.

BOEM occasionally also funds technology development studies. Two such studies underway in FY 2012 are described below. These studies, which are complementary, were undertaken specifically to deal with offshore environmental issues but they could have applications onshore and provide significant benefits beyond BOEM's immediate mission needs both onshore and offshore.

High Definition Aerial Imagery to Survey Birds, Marine Mammals and Sea Turtles on the Atlantic OCS. Greater development of wind energy and other resources has created a critical need for information on the seasonal distributions and abundances of birds and other wildlife that may be affected by such development. Monitoring wildlife offshore has been limited worldwide due to high cost and difficulty of access. Traditional boat transect surveys and observers on "ships of opportunity" are slow and too limited in scope. Traditional aerial surveys have unknown and potentially large errors of estimation and must be flown at a low altitude that disturbs the birds on the ocean surface below, which complicates interpretation of the results obtained. High definition cameras mounted on aircraft show great promise for conducting aerial surveys of offshore wildlife, with minimal error and less disturbance to study subjects. This study was designed to test and evaluate such techniques, and to develop standards and protocols for use of high-definition aerial imagery for offshore surveys that would increase safety while improving sampling estimates at reasonable cost. Both manned and unmanned aircraft were evaluated, as were various cameras, mounting systems, control systems, and data management systems. Equipment protocols were developed to fit the current aircraft fleets of both the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administraion to facilitate rapid adoption by these agencies if desired.

Development of an Acoustic and Thermographic Detection Device for Remote Sampling of Birds and Bats on the Atlantic OCS. Visual surveys of birds and bats on the OCS from manned platforms are extremely expensive and can be highly dangerous. Visual sampling is generally not possible at night. In addition, weather and sea surface conditions can make visual observations very difficult. The purpose of this project was to develop and test a system for detection of birds and bats that would use sound and heat to detect wildlife in both daylight and at night, in any weather conditions, and that could be remotely operated from shore. Acoustic/thermographic surveys used in combination with high definition aerial surveys, described above, could make wildlife monitoring over broad areas of the OCS more cost effective. Together they could yield more robust data sets for the annual, seasonal and diurnal variations in wildlife species in the OCS.

XII. Bureau of Land Management

The BLM's mission is to sustain the health, diversity, and productivity of America's public lands for the use and enjoyment of present and future generations. It administers more public land – over 245 million surface acres – than any other Federal agency in the United States. Most of this land is located in the 12 Western States, including Alaska. The BLM also manages 700 million acres of sub-surface mineral estate throughout the Nation.

The BLM's multiple-use mission, set forth in the Federal Land Policy and Management Act of 1976, mandates that it manage public land resources for a variety of uses, such as energy development, livestock grazing, recreation, and timber harvesting, while protecting a wide array of natural, cultural, and historical resources, many of which are found in the BLM's 27 million-acre National Landscape Conservation System. The conservation system includes 221 Wilderness Areas totaling 8.7 million acres, as well as 16 National Monuments comprising 4.8 million acres. There are opportunities for technology transfer projects related to the management of these areas.

The Department of the Interior has allocated approximately $16-18 million in research and development funding to the BLM annually over the last several years and the majority of that funding goes to applied research projects. BLM defines applied research as systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met. A BLM research project provides fundamental knowledge required for the solution of social, economic, biological, political, technical, or physical problems. Projects are focused to address specific 'researchable' problems recognized by the BLM. They usually have applicability beyond a particular place (site) and time and are usually directed at development of new methodologies and technologies.

Development is defined in the BLM as a systematic process of identifying, adopting, and utilizing knowledge and understanding gained from research, directed toward the production of useful materials, devices, systems, or methods, including design and construction of prototypes and processes. The focus is toward developing and evaluating the feasibility and practicability of proposed implementation (or development) of a particular methodology into daily use, which

is the current process of technology transfer (TT) for the BLM. TT includes, but is not limited to, information dissemination. An example is an in-depth manual explaining how a new technology is to be incorporated into existing procedures, techniques, and training.

The BLM also emphasizes and applies a "landscape approach." Accordingly, it, has been funding Rapid Ecoregional Assessments (REAs). The REAs will provide base data for future projects, which can include TT. Climate change will move the Bureau towards new conceptual models, innovative methods and new practices that more fully integrate science into its everyday work processes. The landscape approach will become the basis for encouraging TT in the BLM.

DATA APPENDIX

Data are provided if they are collected and readily available.

Collaborative Relationships for Research & Development

FY 2012	USGS	FWS	Reclamation	BSEE	TOTAL
● **CRADAs**, total active in the FY(1)	365	4	10		379
- New, executed in the FY	283		1		284
▪ Traditional CRADAs,(2) total active in the FY	17	4	7		28
- New, executed in the FY	5				5
▪ Non-traditional CRADAs,(3) total active in FY	348		3		351
- New, executed in the FY	278		1		279
● **Other collaborative R&D relationships**					
▪ Collaborative Agreements, total active in the FY	275	n/a		8	283
- New, executed in the FY	158	n/a		7	165

CRADA = Cooperative Research and Development Agreement

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).

(2) CRADAs involving collaborative research and development by a Federal laboratory and non-Federal partners.

(3) CRADAs used for special purposes -- such as, material transfer or technical assistance that may result in protected information.

Invention Disclosure and Patenting

FY 2012	USGS	Reclamation	TOTAL
● New inventions disclosed in the FY(1)	6	4	10
● Patent applications filed in the FY(2)	2	1	3
● Patents issued in the FY	2	1	3

(1) Inventions arising at the Federal lab.

(2) Tally includes: U.S. patent applications, foreign patent applications filed on cases for which no U.S. application was filed, divisional applications, and continuation-in-part applications. Excludes: provisional, continuation, duplicate foreign, and PCT applications

Licensing

Profile of Active Licenses

FY 2012	USGS	FWS	Reclamation	TOTAL
● **All licenses**, number total active in the FY[1]	20	1	5	26
▫ New, executed in the FY	1			1
▪ **Invention licenses**, total active in the FY	20	1	3	24
▫ New, executed in the FY	1			1
- Patent licenses,[2] total active in FY	20	1		21
▫ New, executed in the FY				
- Material transfer (inventions), total active in FY				
▫ New, executed in the FY				
- Other invention licenses,[3] total active in FY				
▫ New, executed in the FY				
▪ **Other IP licenses**, total active in the FY			2	2
▫ New, executed in the FY				
- Copyright licenses (fee bearing), total active in FY				
▫ New, executed in the FY				
- Material transfer (non-inv.), total active in FY				
▫ New, executed in the FY				
- Other [4]				
▫ New, executed in the FY				

Multiple inventions in a single license are counted as one license. Licenses that include both patents and copyrights (I.e., hybrid licenses) are reported as patent licenses -- and not included in the count of copyright licenses.

(1) "Active" = legally in force at any time during the FY.

(2) Patent license tally includes patent applications which are licensed.

Profile of Active Licenses (cont.)

FY 2012	USGS	Reclamation	TOTAL
● **All income bearing licenses**, number	19	3	22
▫ Exclusive	12		12
▫ Partially exclusive			
▫ Non-exclusive	7	3	10
▪ **Invention licenses**, income bearing	19		19
▫ Exclusive	12		12
▫ Partially exclusive			
▫ Non-exclusive	7		7
- Patent licenses,(1) income bearing	19		19
▫ Exclusive	12		12
▫ Partially exclusive			
▫ Non-exclusive	7		7
▪ **Other IP licenses**, income bearing			
▫ Exclusive			
▫ Partially exclusive			
▫ Non-exclusive			
- Copyright licenses (fee bearing)			
▫ Exclusive			
▫ Partially exclusive			
▫ Non-exclusive			
● **All royalty bearing licenses**,(2) number	19	3	22
▪ **Invention licenses**, royalty bearing	19	3	22
- Patent licenses,(1) royalty bearing	19		19
▪ **Other IP licenses**, royalty bearing			
- Copyright licenses (fee bearing)			

In general, license income can result from various sources: license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(1) Patent license tally includes patent applications which are licensed.

(2) Note that royalties are one component of total license income.

Licensing Management

FY 2012	USGS	FWS	Reclamation	TOTAL
● **Number of licenses**				
▪ **Invention licenses**, total active in the FY	20	1	3	24
▫ New, executed in the FY	1			1
● **Elapsed execution time**,(1) licenses granted in FY				
▪ **Invention licenses**	1			1
▫ average (months)	12		7	19
▫ minimum (months)	12		1	13
▫ maximum (months)	12		11	23
- Patent licenses(2)	1			1
▫ average (months)	12			12
▫ minimum (months)	12			12
▫ maximum (months)	12			12
● L**icenses terminated for cause,** in the FY				
▪ **Invention licenses**				
- Patent licenses(2)				

License Income

FY 2012	USGS	Reclamation	TOTAL
● **Total income**, all licenses active in FY (1)	$66,796	$11,324	$78,120
▪ **Invention licenses**	$66,796	$11,324	$78,120
- Patent licenses (2)	$66,796	$11,324	$78,120
▪ **Other IP licenses**, total active in the FY			
- Copyright licenses			
● **Total Earned Royalty Income** (ERI) (3)	$62,696		$62,696
▫ Median ERI	$1,000		$1,000
▫ Minimum ERI			
▫ Maximum ERI	$20,685		$20,685
▫ ERI from top 1% of licenses	$20,685		$20,685
▫ ERI from top 5% of licenses	$20,685		$20,685
▫ ERI from top 20% of licenses	$53,648		$53,648
▪ **Invention licenses,** total ERI	$62,696		$62,696
▫ Median ERI	$1,000		$1,000

License Income

FY 2012	USGS	Reclamation	TOTAL
▫ Minimum ERI			
▫ Maximum ERI	$20,685		$20,685
▫ ERI from top 1% of licenses	$20,685		$20,685
▫ ERI from top 5% of licenses	$20,685		$20,685
▫ ERI from top 20% of licenses	$53,648		$53,648
- Patent licenses,(2) total ERI	$62,696		$62,696
▫ Median ERI	$1,000		$1,000
▫ Minimum ERI			
▫ Maximum ERI	$20,685		$20,685
▫ ERI from top 1% of licenses	$20,685		$20,685
▫ ERI from top 5% of licenses	$20,685		$20,685
▫ ERI from top 20% of licenses	$53,648		$53,648
▪ **Other IP licenses**, total ERI			
▫ Median ERI			
▫ Minimum ERI			
▫ Maximum ERI			
▫ ERI from top 1% of licenses			
▫ ERI from top 5% of licenses			
▫ ERI from top 20% of licenses			
- Copyright licenses, total ERI			
▫ Median ERI			
▫ Minimum ERI			
▫ Maximum ERI			
▫ ERI from top 1% of licenses			
▫ ERI from top 5% of licenses			
▫ ERI from top 20% of licenses			

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

(2) Patent license tally includes patent applications which are licensed.

(3) "Earned royalty" = royalty based upon use of a licensed invention (usually, a percentage of sales or of units sold). Not a license issue fee or a minimum royalty.

Disposition of License Income

FY 2012	USGS	Reclamation	TOTAL
● **Income distributed** [1]			
▪ **Invention licenses**, total distributed	$73,303	$6,799	$80,102
- To inventors	$34,857	n/a	$34,857
-To other[2]	$38,446	n/a	$38,446
- Patent licenses,[3] total income distributed	$73,303	$6,799	$80,102
- To inventors	$34,857	n/a	$34,857
-To other[2]	$38,446	n/a	$38,446

Data in this table (intentionally) addresses only invention licenses -- with patent licenses distinguished as a subclass.

(1) Income includes royalties and other payments received during the FY.

(2) Please provide a note indicating the categories of recipients included in "to other"

(3) Patent license tally includes patent applications which are licensed.

n/a = Data not available from agency at time of this report.