DEPARTMENT OF ENERGY FUNDS-OUT INTERAGENCY AGREEMENT

1. a. ADDRESS OF ISSUING DOE OFFICE U.S. Department of Energy Idaho Operations Office 850 Energy Drive, MS-1221 Idaho Falls, ID 83401-1563	2. a. RECIPIENT/PERFORMING AGENCY U. S. Department of Interior U. S. Geological Survey (USGS) Water Resources Division, Western Region Regional Hydrologist 345 Middlefield Road, MS 470 Menlo Park, CA 94025 U. S. Department of Interior U. S. Geological Survey, Water Resources Division 230 Collins Road Boise, Idaho 83702
b. ADMINISTERED FOR DOE BY U.S. Department of Energy Idaho Operations Office 850 Energy Drive, MS-1221 Idaho Falls, ID 83401-1563 Kara L. Twitchell, Contract Specialist, (208) 526-4958; Fax (208) 526-5548 twitchlk@id.doe.gov	b. BUSINESS CONTACT Patrick M. Lambert, Acting District Chief Same address as 2.a. (208) 387-1300; Fax (208) 387-1372 plambert@usgs.gov USGS #ID-0241
3. a. DOE IA No.: DE-AI07-02ID14307 b. Modification No. A000 c. PR No. 07-02ID14307.000 d. Recipient/Performing Agency Agreement No.:	c. PROGRAM DIRECTOR/TECHNICAL CONTACT Joseph P. Rousseau, Project Chief INEEL Project Office, MS 1160 (208) 526-2439; Fax (208) 526-6002 jprousse@usgs.gov
4. TYPE OF ACTION (X) New ( ) Incremental ( ) Renewal ( ) Other	5. AUTHORITY The Economy Act of 1932 (31 U.S.C. 1535); P.L. 95-91; other:
6. PROJECT TITLE: Geohydrologic Studies and Assistance in Characterizing and Monitoring the Regional Subsurface Environment at and near the Idaho National Engineering and Environmental Laboratory (INEEL) Attachment 1, Statement of Work Attachment 2 (A000)	
7. a. PROJECT PERIOD From: October 1, 2001 To: September 30, 2006 (A000)	b. FUNDING PERIOD From: October 1, 2001 To: September 30, 2002 (A000)

8. ACCOUNTING AND APPROPRIATIONS DATA a. Prior Funding Obligations $0

b. Approp. Symbol	c. B&R No.	d. Amount	e. Allotment Symbol/FT/AFP/OC	f. CFA No.
89X0242.91	EW02D1150	$1,000,000	253 ORM-101 XID=00000493	
89X0222.91	820101000	$ 38,000	253 OPI CH90 WA FUND TYPE	
			FLUCH 900003 XID=LAURIE	
Schedule of	Agreement	Value and funding	Obligations – Attachment 3	
g. *Total Funds Obligated This Action* $1,038,000.00			h. *Total Funding Obligated* $1,038,000.00	

9. METHOD OF PAYMENT: ___Advance _XX_ Reimbursement	10. BILLING INSTRUCTIONS: XX IPAC ___S.F. 1080 Invoice Submit to: U.S. Department of Energy Idaho Operations Office Financial Services Division 850 Energy Drive, MS-1242 Idaho Falls, ID 83401-1563
11. DOE PROGRAM OFFICER U.S. Department of Energy Idaho Operations Office 850 Energy Drive, MS 1216 Richard M. Kauffman, Program Manager kauffmrm@id.doe.gov (208) 526-7177; Fax (208) 526-1926	
12. DOE CONTRACTING OFFICER (SIGNATURE) 4/17/02 (DATE) NAME /TITLE: DALLAS L. HOFFER CONTRACTING OFFICER	13. ACCEPTANCE: (SIGNATURE) 4/18/02 (DATE) NAME/TITLE: WILLIAM SEXTON REGIONAL HYDROLOGIST
	14. GENERAL PROVISIONS/REQUIREMENTS Reference A000

Funds-Out Interagency Agreement General Provisions/Requirements
Department of Energy Interagency Agreement

1. Incurrence of Costs. The recipient/performing agency is not authorized to expend or commit funds in excess of the amount obligated. It is anticipated that the funds provided by this Agreement will be insufficient to complete the entire five-year work requirements, the written approval of the DOE Contracting Officer must be obtained prior to the incurrence of costs in excess of the amount provided.

2. Delivery Requirements (if any): The Agreement statement of work (SOW) Attachment 2 defines the deliverables to be submitted.

3. Reporting Requirements. If checked X technical reports shall be submitted to DOE, which documents and summarizes all of the work completed under this Agreement. Reports shall be emailed to the DOE Contract Administrator (Face page, Block 1b) and ___ DOE Program Manager (Block 11). If checked, ___ one copy of research reports or formal publications should also be emailed to the DOE Office of Science & Technical Information (OSTI) Energy Link (E-link) at http://www.osti.gov/elink.

   Additional reporting requirements to be submitted to the Contract Administrator and Program Manager:

Description of Deliverables	Frequency	Email
Technical Progress Report	Quarterly	Face page, Blocks 1b and 11

   NOTE: Reference agreement Attachment 1 for additional report requirements and information.

4. Patents and Technical Data. Disposition of rights to inventions made in any contract, grant or cooperative agreement under this Agreement with any small business firm or domestic nonprofit organization will be in accordance with 35 U.S.C. 200-212. In all other contracts, grants or cooperative agreements under this Agreement, the performing agency shall coordinate the disposition of rights in inventions with the DOE Patent Counsel.

5. Issue Resolution. Unless otherwise indicated below, it is expected that programmatic guidance will be handled through discussions between the staff of the Performing Agency Program Director/Technical Contact listed in the Face page, Block 2c and the DOE Program Manger, Face page Block 11. Any administrative issues including billing questions, unresolved items or issues requiring a formal change to this Agreement shall be addressed to the DOE Contracting Officer, Face page, Block 12.

6. Termination. DOE may terminate this Agreement upon 30 days written notice of such termination addressed to the performing agency. In the event of such termination the performing agency shall be reimbursed, to the extent permitted, for obligations actually incurred to the effective date of the termination and for commitments extending beyond the effective date of termination to a date not later than the date upon which the Agreement would have expired if not terminated under this paragraph, which the performing agency, in the exercise of due diligence, is unable to cancel. Payments under this Agreement, including payments under this article shall not exceed the amount(s) committed under this Agreement.

Funds-Out Interagency Agreement General Provisions/Requirements
Department of Energy Interagency Agreement

7. Financing.

   a. DOE authorized the Performing Agency to expend funds in adherence to the requested work and/or deliverables cited herein. DOE's preferred method for reimbursing the Performing Agency is via the Intra-governmental Payment and Collection System (IPAC). Each IPAC charge must clearly make reference to DOE's IA No. Cited in block 3.a. and must be supported with the appropriate documents cited in Paragraph 3. above. If IPAC is not a satisfactory billing method, a mutually agreeable alternative should be negotiated before acceptance of this Agreement.

   b. When applicable, vouchers for payments will be submitted on the agreed upon form.

   c. When applicable, any funds advanced which are expected to remain beyond the original period of performance for a project which is incomplete, or for which there is an increased scope of work, will remain available to the Performing Agency if the Agreement is amended by the DOE to extend the period of performance for the work beyond the original completion date. Request for such time extensions should be made to the DOE by the Performing Agency at least 30 days prior to the end of the performance period.

   d. When applicable, any funds advanced for a continuing project remain available for the entire performance period of the project, unless there is a date specified as a required completion date after which no further funds shall be expended.

8. Other Provisions.

U.S. Geological Survey INEEL Project Office FY 2002 Task Plan

Water Resources Division
Idaho National Engineering and Environmental Laboratory
MS 1160, P.O. Box 2230
Idaho Falls, Idaho 83403-2230

February 4, 2002

Mr. Richard Kauffman
U.S. Department of Energy
Idaho Operations Office, MS 1146
850 Energy Drive
Idaho Falls, ID 83402

Subject: USGS Task Plan for work to be accomplished in fiscal year 2002 under Contract Number DE-A107-02ID14307

Dear Mr. Kauffman:

Enclosed is the draft USGS INEEL Project Office Task Plan for fiscal year 2002, including a detailed breakdown of program costs for the fiscal year. This Task Plan defines the goals and funding levels for work that will be conducted by the U.S. Geological Survey's INEEL Project Office through Contract Number DE-A107-02ID14307 in FY 2002 and provides funding estimates for the years 2003-2007.

This task plan includes work elements associated with two flood-hazard studies for the Big Lost River funded by DOE through Mods A011, A012, and A013 to the FY 2000 Task Plan. Work began on these studies in FY 2000 and will be completed during the current fiscal year. Also included is a proposal for conducting tracer tests in the Big Lost River and spreading areas near the RWMC. This proposal was partially funded through Mod A010 to the FY 2000 Task Plan to purchase tracers in FY 2000 for the test. These tracers are available to conduct the test if streamflow is sufficient. Paleomagnetic studies on INEEL cores are included in the FY 2002 Task Plan to evaluate stratigraphic and structural controls on ground-water flow. We believe that the paleomagnetism proposal is extremely important in our continuing effort to characterize flow and contaminant transport. The Task Plan does not include funding already provided through FY 2000 and 2001 modifications to the agreement for I-129 analyses and flood hazard study.

I hope this information meets your needs. If additional information is needed, please call at your convenience.

With best regards,

Joseph P. Rousseau
Supervisory Hydrologist
Enclosures
cc: F.O. Alexander, DOE-ID, MS 1240
C.R. Nichols, DOE-ID, MS 1203
J.N. Perry, DOE-ID, MS 1101
K.L Twitchell, DOE-ID, MS 1221
District Chief, USGS, Boise, ID

TABLE OF CONTENTS

ATTACHMENTS

A. Proposal for Additional Stream-Gaging Stations on the Big Lost River, Little Lost River, Birch Creek, and Antelope Creek

B. Multiple-Tracer Study, INEEL Spreading Areas and Big Lost River

TASK PLAN -- 2002 FISCAL YEAR

U.S. GEOLOGICAL SURVEY GEOHYDROLOGIC STUDIES

BACKGROUND AND OBJECTIVES

The Snake River Plain aquifer of southeastern Idaho, a part of which underlies the Idaho National Engineering and Environmental Laboratory (INEEL), is an important resource to both the State of Idaho and the U.S. Department of Energy (DOE). The entire water supply for the INEEL-including drinking water-is obtained from the Snake River Plain aquifer. At the INEEL, the aquifer is part of an extensive geohydrologic system that also includes a thick overlying unsaturated zone, perched ground-water zones, and ephemeral streams, playas, and water-diversion areas.

In places, the Snake River Plain aquifer, unsaturated zone, and perched ground-water zones contain substantial amounts of low-level radioactive- and chemical-aqueous wastes generated by activities at the INEEL. From 1952 to 1984, aqueous wastes were either injected directly into the aquifer through disposal wells or discharged to infiltration ponds. Routine effluent discharge to the last remaining wastewater disposal well was discontinued in February 1984 following construction of a percolation pond although the well was still used in emergency situations from 1984 to 1986.

Ponded wastewater infiltrates the soil and underlying rock units and eventually percolates downward to the aquifer. Perched ground-water zones have formed in places where the downward movement of wastewater is impeded because of a decrease in vertical hydraulic conductivity. As wastewater reaches the aquifer, it moves downgradient toward the southern boundary of the INEEL.

Because of continued concern about water pollution and data needs derived from the INEEL Site-wide Ground-Water Monitoring Plan and the Environmental Restoration Program, an extensive network for collecting geohydrologic, hydraulic, geochemical, and radiochemical data has been designed and implemented by the U.S. Geological Survey (USGS) in cooperation with the DOE Idaho Operations Office. The data are used in interpretive studies to describe the temporal and spatial distribution of the radioactive- and chemical-waste solutes and to define and describe the processes that control their concentration and migration rates. These processes include dispersion, adsorption, dilution, radioactive decay, and chemical reactions. This information is an integral part of a comprehensive assessment of ground-water and water-quality conditions at the INEEL and is used by the DOE and its contractors, Region 10 of the U.S. Environmental Protection Agency, and the State of Idaho.

Responsibility for the regional component of ground-water monitoring conducted under the INEEL Site-wide Ground-Water Monitoring Plan resides with the USGS. The plan uses a subset of wells from the existing regional observation well network maintained and sampled by the USGS, and includes recommendations for several new wells. The regional wells selected for inclusion in the plan provide a connection between the area-specific monitoring networks and offer supplementary monitoring support for area-specific wells. Many of these USGS wells have a long data-acquisition history, permitting recognition and tracking of long-term trends. The wells generally obtain water from open aquifer intervals of 50 to 200 feet. The long open intervals offer the possibility of detecting contaminants that might be missed by wells with shorter open intervals.

The principal objectives of the monitoring networks and interpretive studies are to provide detailed descriptions of the effects of waste disposal on the quality of ground water contained in the Snake River Plain aquifer and to define the capacity of the geohydrologic system to accept and assimilate the wastes. Geologic and hydrologic complexities of the aquifer at the INEEL require a continuing data-collection program in order to provide a detailed description of the migration of radioactive and chemical solutes in the

subsurface. Additionally, INEEL operational activities and the disposal of wastes to the environment are continually changing and require frequent monitoring and interpretation of their effects on the Snake River Plain aquifer. The monitoring networks and studies also provide the baseline data that will be needed to support future geohydrologic research designed to resolve problems concerning the migration and disposition of radioactive and chemical wastes. Interpretive reports are prepared and released to document the findings of the research. Recently, the USGS opened the National Water Information System (NWIS) web site to the public. This system permits public electronic access and retrieval of USGS water data, including INEEL. The address is http://water.usgs.gov/nwis/.

USGS staff at the INEEL are available to the DOE and its contractors to develop and interpret information, to advise, and to collect additional data on a wide array of geohydrologic problems, including waste disposal, waste migration, site remediation, well rehabilitation, water supply, flood control, streamflow, and pond-water infiltration. The USGS is coordinating closely with DOE contractors to insure against any duplication of effort while maximizing the integration of information.

The USGS program at the INEEL is dynamic and of a continuing and long-term nature. This program has three major components: (I) Geohydrologic Studies; (II) Environmental Restoration Program Support; and (III) Special Hydrologic Studies. Fiscal-year 2002 work elements of these components are described in the following sections. INEEL Project deliverables and milestones for FY2002 are described in table 1. Table 2 is a compilation of reports that were submitted to DOE for cooperator review or were processed for distribution after submittal to DOE during FY2001. Table 3 is a compilation of reports that are planned for release during FY2002 contingent upon completion of report processing steps 6 through 10 following cooperator review (step 5). See description of report processing steps below.

Note: The numerical codes used to designate the status of a particular report in tables 1 and 2 are as follows. These codes are shown in parentheses () following an abbreviated title of the report.

0. Draft report not yet begun.	6. Responses to cooperator and editorial reviews.
1. Preparation of the draft report.	7. Submittal for USGS Director's approval.
2. Supervisory review and responses.	8. Response to comments from approval process.
3. Colleague technical reviews.	9. Preparation for printing.
4. Response to technical reviews.	10. Report distribution.
5. Simultaneous submittals to DOE and USGS for cooperator and editorial reviews.	

Table 1: U.S. Geological Survey INEEL Project Deliverables and Milestones for FY 2002

Investigations by Category	Deliverable	Milestone Date FY 01	Milestone Date FY 02
	Reports to Department of Energy describing progress on deliverable milestones		Quarterly, 30 days after end of quarter
	I. GEOHYDROLOGIC STUDIES		
A. Hydrologic Monitoring	INEEL water-quality sampling, first quarter, FY 02 (Multiple analytes from approximately 105 ground-water and surface-water sites)		Oct 31, 2001
	INEEL water-quality sampling, third quarter, FY 02 (Multiple analytes from approximately 94 ground-water and surface-water sites)		Apr 30, 2002
	INEEL water-quality sampling, fourth quarter, FY 02 (Multiple analytes from approximately 73 ground-water and surface-water sites)		Jul 30, 2002
	More than 800 measurements of water levels in approximately 200 wells and numerous shallow auger holes, with continuous recorders on selected wells.		Ongoing
	Historical and statistical analysis of the existing USGS hydrologic network for monitoring water-quality and water-levels in the Snake River Plain aquifer at the INEEL. Also, see reports H-1 and H-2.		Ongoing
	Analysis of contaminant migration. Also, see report H-4.		Ongoing
	Well security upgrades.		Sep 30, 2002
B. Recharge	Assessment of recharge from channel losses and from areal precipitation. Also, see Table 2 report 20.		Ongoing
C. Framework	Drilling of a corehole at EBR-1 to a depth of approximately 1200 ft to evaluate stratigraphic and structural controls on ground-water flow.		Jun 2002
	Deepening of USGS-128 north of the Central Facilities Area landfill to evaluate stratigraphic and structural controls on ground-water flow.		Aug 2002
	Construction of up to two coreholes south of INTEC to evaluate the distribution of units 1 and 2, to characterize unsaturated-zone interbeds, and to support INEEL in characterization of iodine-129 distribution in the H-I interbed.		Nov 2002
	Study of vent corridors and their influence on preferential flow in the Snake River Plain aquifer. Collaborative effort with Idaho State University. Master's Thesis. Also, see Table 2 report 22.		Ongoing
	Paleomagnetic, chemical, and stratigraphic studies of new basalt cores. Collaborative effort with Idaho State University, Master's Thesis.		Ongoing

Investigations by Category	Deliverable	Milestone Date FY 01	Milestone Date FY 02
C. Framework -- Continued	Characterization of sediment in the Big Lost Trough. Collaborative effort with Idaho State University, Master's Thesis.		Ongoing
	Characterization of basalt geochemistry from selected cores between INTEC and RWMC. Collaborative effort with Idaho State University, Master's Thesis.		Ongoing
	Development of GIS coverages of stratigraphic and hydrogeologic data. Also, see reports H-8, H-9, H-10.		Ongoing
	Development of an interactive web page showing selected GIS coverages and stratigraphic data for 333 wells.		Ongoing
	Characterization of paleomagnetic properties of INEEL cores to evaluate stratigraphic and structural controls on ground-water flow at the INEEL.		Dec 2002
D. Water-Rock Interactions	Development of reaction-path models of ground-water chemistry in tributary valleys that recharge the Snake River Plain aquifer at the INEEL. Collaborative effort with Idaho State University. Also, see reports H-3 and H-15.		Ongoing
	Development of a conceptual model that integrates the thermodynamic conditions and mixing at the INEEL. Also, see report H-16.		Ongoing
	Development of a local meteoric water line using stable hydrogen and oxygen isotope data. Also, see report H-17.		Sep 2002
	Development of a combined reaction path/mixing model using NETPATH or other geochemical tools to describe the impacts of waste disposal on the geochemistry of water at and downgradient from the INEEL.		Ongoing
E. Hydraulic Properties	Development of drilling and field-testing methodology for coring and in-situ determination of the hydraulic properties of the sedimentary interbeds. Also, see reports H-5 and H-6.		Ongoing
F. Calibration of Numerical Models	Development of a conceptual model of flow in the Snake River Plain aquifer at the INEEL. Also, see report H-7.	Dec 2000	Jan 2002
	Development of steady-state flow models of flow in the Snake River Plain aquifer at the INEEL. Also, see report H-8.	Mar 2001	May 2002
	Development of transient flow models of flow in the Snake River Plain aquifer at the INEEL. Also, see report H-9.	Sep 2001	Dec 2002
	Development of contaminant transport models of flow in the Snake River Plain aquifer at the INEEL. Also, see report H-10.	Jun 2002	FY 2003
	Evaluation of the internal consistency of flow and transport models using independent lines of evidence, including tempertature, trace elements, and whole-water chemistry. Also, see report H-11.	Mar 2003	FY 2003
G. Data Bases	Maintenance of local and national USGS water-level, water-quality, and streamflow databases.		Ongoing
	Development of a local USGS database for archiving of selected contractor, and State-Oversight Program water-level and water-quality data.		Ongoing

Investigations by Category	Deliverable	Milestone Date FY 01	Milestone Date FY 02
G. Data Bases -- Continued	Distribute data to site contractors, governmental agencies, universities, and the general public as requested.		As required
H. Reports	1. Historical development of the U.S. Geological Survey hydrologic monitoring program and ancillary activities at the Idaho National Engineering and Environmental Laboratory, Idaho (3)	Cooperator review, Aug 2001	Cooperator review, Nov 2001
	2. Report – Evaluation of the USGS hydrologic monitoring and drilling programs at the INEEL (phase 2). Geo-statistical and time-series evaluation of water-level monitoring data. (0)	Cooperator review, Aug 2001	Cooperator review, FY 2003
	3. Report – Geochemistry of the Little Lost River drainage system (3)	Cooperator review, Sep 2001	Cooperator review, Dec 2001
	4. Report – 1994 post audit of background concentrations of I-129 in ground and surface water, eastern Snake River Plain, Idaho, 1992 (3)	Cooperator review Mar 2001	Cooperator review, Mar 2002
	5. Report – A recommended drilling methodology for coring sedimentary interbeds near the RWMC (1)	Cooperator review, Feb 2001	Cooperator review, May 2002
	6. Report – second in series of hydraulic property measurements of interbed materials (1)	Ongoing	Cooperator review, Sep 2002
	7. Report – 3-D conceptual model of flow in the Snake River Plain aquifer at and near the INEEL (4)	Cooperator review, Dec 2000	Cooperator review, Jan 2002
	8. Report – Steady-state flow model of INEEL subregion (1)	Cooperator review, Mar 2001	Cooperator review, May 2002
	9. Report – Transient flow model of INEEL subregion (0)	Cooperator review, Sep 2001	Cooperator review, Dec 2002
	10. Report – Transport model of INEEL subregion (0)	Cooperator review, Jun 2002	Cooperator review, FY 2003
	11. Report – Evaluation of the internal consistency of flow and transport models using independent lines of evidence (0)	Cooperator review, Mar 2003	Cooperator review, FY 2003
	12. Report – Radiochemical and chemical constituents from selected sites from the southern boundary of the INEEL to Hagerman, 2001 (1)	Not in 2001 Task Plan	Cooperator review, Sep 2002
	13. Report – Evaluation of flood flow characteristics of bedrock constrictions in the Big Lost River downstream of the INEEL diversion (1)	Cooperator review, Jun 2001	Cooperator review, Dec 2001
	14. Report – Evaluation of the effects of travel time and channel infiltration losses from tributary sub-basins on flood flows of the Big Lost River (1)	Cooperator review, Nov 2001	Cooperator review, Dec 2001

Investigations by Category	Deliverable	Milestone Date FY 01	Milestone Date FY 02
H. Reports – Continued	15. Report – Geochemistry of the Birch Creek drainage basin, Idaho (1)		Cooperator review, Jun 2002
	16. Report – Conceptual mixing model of the Snake River Plain aquifer in the western part of the Idaho National Engineering and Environmental Laboratory, Idaho (1)		Cooperator review, Sep 2002
	17. Report – Development of a local meteoric water line for southeastern Idaho and western Wyoming (1)		Cooperator review, Sep 2002
	18. Report – Paleomagnetic data from selected coreholes (0)		Cooperator review, Nov 2002
	19. Report – Tritium in flow from selected springs that discharge to the Snake River, Twin Falls-Hagerman area, Idaho, 1994-1999 (5)		Cooperator review, Jan 2002
II. ENVIRONMENTAL RESTORATION PROGRAM SUPPORT			
A. Federal Facilities Agreement and Consent Order	Construction of USGS INEEL Project home page on the internet		Ongoing
	Routine operation of the INEEL core library		As required
	Geophysical logging of boreholes and wells		As required
B. RWMC Studies	Characterization of the hydraulic properties of the sedimentary interbeds, including development of laboratory and in situ testing methodologies, development of coring techniques, and drilling of test boreholes. See reports H-5, H-6.		Ongoing
	Multiple-tracer study in the INEEL spreading areas and Big Lost River to evaluate sources of vadose-zone water at the RWMC. (Mod A010-funding for tracer procurement. See attached proposal – ATT. B).)		Contingent on funding and runoff availability in the Big Lost River
C. Well rehabilitation	Repair and maintenance of USGS wells to comply with INEEL environmental and physical security requirements.		Ongoing
D. Interim Risk Assessment Analysis–WAG-7 13&14 OU	Independent technical review of the Interim Risk Assessment Analysis for the Radioactive Waste Management Complex, WAG-7 13&14 Operable Units. (See Table 2, Report 17)	Cooperator/colleague review, Nov 2000	To be released as an Administrative Report, FY 2002
III. SPECIAL HYDROLOGIC STUDIES			
A. Magic Valley water quality	Magic Valley water-quality sample collection – Samples from approximately 18 wells and springs. Also, see report H-12.		Aug 2002
B. Big Lost River gaging stations	Operation of stream gaging-stations on the Big Lost River, provision for real-time streamflow data. Data presented in the Idaho District annual report		Ongoing, real-time data as required

Investigations by Category	Deliverable	Milestone Date FY 01	Milestone Date FY 02
C. Flood hazards	Study to evaluate the flood flow characteristics of bedrock constrictions in the Big Lost River. Funded through Mod A011. See report H-13. (Mods A011 and A013)	Jun 2001	Dec 2001
	Study to evaluate the effects of travel time and channel infiltration losses from tributary sub-basins on the flood hydrograph of the Big Lost River at Arco. See report H-14. (Mod A012)	Nov 2001	Dec 2001
D. Tracer studies	See ATT B – Spreading Area tracer test to be funded through a separate modification to the agreement.		Contingent on availability of streamflow
E. Special INEEL studies	Miscellaneous special studies and reviews requested by DOE and contractors (See summary of FY 2001 activities and projected FY 2002 activities, Table 4)		As required

Table 2: U.S. Geological Survey INEEL Project FY-01 reports at or past DOE review at the end of the fourth quarter, 2001.

Investigations by Category	Deliverable	Milestone Date	Status
Reports	1. Laboratory and field hydrologic characterization of the shallow subsurface at an INEEL waste-disposal site	Not identified in the 2001 Task Plan	The report was released as WRIR 99-4263 (DOE/ID-22163) (10)
	2. Chemical, isotopic, and gas compositions of ground and surface waters from selected sites in and near the INEEL, 1994-97	Cooperator review, Feb 2000	The report was released as OFR 00-81 (DOE/ID-22164) (10)
	3. Chemical and radiochemical constituents in water from wells in the vicinity of the NRF, 1997-98	Not identified in the 2001 Task Plan	The report was released as OFR 00-236 (DOE/ID-22165) (10)
	4. In situ production of chlorine-36 in the eastern Snake River Plain aquifer, Idaho: Implications for describing ground-water contamination near a nuclear facility	Cooperator review, Jan 2000	The report was released as WRIR 00-4114 (DOE/ID-22166) (10)
	5. Hydrologic conditions and distribution of selected radiochemical and chemical constituents in water SRPA, INEEL, 1996 through 1998	Cooperator review, Jun 2000	The report was released as WRIR 00-4192 (DOE/ID-22167) (10)
	6. Distribution of selected radiochemical and chemical constituents in perched ground water, INEEL, 1996-98	Cooperator review, Aug 2000	The report was released as WRIR 00-4222 (DOE/ID-22168) (10)
	7. Radiochemical and chemical constituents from selected sites from the southern boundary of the INEEL to Hagerman, 1999	Cooperator review, Aug 2000	The report was released as OFR 00-399 (DOE/ID-22169) (10)
	8. Measurement of hydraulic properties of the B-C interbed and their influence on contaminant transport in the unsaturated zone at the INEEL	Not identified in the 2001 Task Plan	The report was released as WRIR 00-4073 (DOE/ID-22170) (10)
	9. Hydrologic and meteorological data for an unsaturated-zone study area near the RWMC	Not identified in the 2001 Task Plan	The report was released as OFR 00-248 (DOE/ID-22171) (10)
	10. Chemical and radiochemical constituents in water from wells in the vicinity of the NRF, 1999	Not identified in the 2001 Task Plan	The report was released as OFR 01-27 (DOE/ID-22172) (10)
	11. Chemical composition of selected solid-phase samples from the Snake River Plain aquifer system and contributing drainages	Cooperator review, Feb 2001	The report was released as OFR 01-36 (DOE/ID-22173) (10)

Table 2: U.S. Geological Survey INEEL Project FY-01 reports at or past DOE review at the end of the fourth quarter, 2001 -- Continued.

Investigations by Category	Deliverable	Milestone Date	Status
Reports -- Continued	12. Geochemistry of the Big Lost River Valley aquifer system	Cooperator review, Sep 2000	The report was released as WRIR 01-4031 (DOE/ID-22174) (10)
	13. Radiochemical and chemical constituents in water from selected wells south of the INEEL	Not identified in 2001 Task Plan	The report was released as OFR 01-38 (DOE/ID-22175) (10)
	14. Hydrologic and meteorological data for an unsaturated-zone study near the RWMC, 1997- 99	Not identified in 2001 Task Plan	The report was released as OFR 00-248 (DOE/ID-22171) (10)
	15. Chlorine-36 in the Snake River Plain aquifer, a one-dimensional system response simulation	Cooperator review, Feb 2000	The report was released as an Article in the Journal of Nuclear Instrumentation and Methods in Physics Research, Nov 00 (10)
	16. Determination of variables in prediction of strontium distribution coefficients for selected sedimentary samples	Not identified in 2001 Task Plan	The Article was published in the Journal of Environmental Geology (10).
	17. Independent technical review of the Interim Risk Assessment Analysis for the RWMC, Waste Area Group 7 -13 & 14 Operable Units	Cooperator review, Sep 1999	The report was being prepared for Director's approval as an administrative report subsequent to colleague and cooperator reviews (6).
	18. Measurement of hydraulic properties of the B-C interbed and their influence on contaminant transport in the unsaturated zone at the INEEL	Cooperator review, Jan 2000	The approved report was released as WRIR 00-4073 (DOE/ID-22170) (10)
	19. Report – Rapid transport of a naphthalene sulfonate tracer in the unsaturated and saturated zones near the Big Lost River flood control areas at the INEEL	Cooperator review, Dec 2000	The approved report was submitted to the journal of Water Resources Research, but was rejected. The report is in preparation for submittal to the Vadose Zone Journal (9).
	20. Report – Age of the ground water at the INEEL: results from CFC's, tritium/helium-3, sulfur hexafluoride, and other environmental tracers	Cooperator review, Mar 2001	The report was being prepared for Director's approval as a Water-Resources Investigations report.
	21. Radiochemical and chemical constituents from selected sites from the southern boundary of the INEEL to Hagerman, 2000	Cooperator review, Sep 2001	The approved report was being prepared for release as OFR 01-358 (DOE/ID-22176) (9)
	22. Physical characteristics of vent corridors (in preparation by journal for publication)	Not identified in 2001 Task Plan	The approved article is to be published in a special GSA Proceedings in Nov 2001.
	23. Ages and accumulation rates of subsurface basalt flows (in preparation by journal for publication) (9)	Not identified in 2001 Task Plan	The approved article is to be published in a special GSA Proceedings in Nov 2001.

Table 3: U.S. Geological Survey INEEL Project reports planned for publication, Fiscal Year 2002.

Investigations by Category	Reports Planned for Release during FY 2002
Reports	1. 3-D conceptual model of flow in the Snake River Plain aquifer at and near the INEEL (4)
	2. Independent technical review of the Interim Risk Assessment Analysis for the RWMC, Waste Area Group 7 –13 & 14 Operable Units (USGS administrative report) (6)
	3. A recommended drilling methodology for coring sedimentary interbeds near the RWMC (1)
	4. Age of ground water at the INEEL: results from CFC's, tritium/helium-3, sulfur hexafluoride, and other environmental tracers (6)
	5. Rapid transport of a naphthalene sulfonate tracer in the unsaturated and saturated zones near the Big Lost River flood control areas at the INEEL (9)
	6. Steady-state flow model of the INEEL subregion (1)
	7. Transient flow model of the INEEL subregion (0)
	8. Historical development of the U.S. Geological Survey hydrologic monitoring program and ancillary activities at the Idaho National Engineering and Environmental Laboratory, Idaho (3)
	9. Radiochemical and chemical constituents from selected sites from the southern boundary of the INEEL to Hagerman, 2000 (9)
	10. 1994 post audit of background concentrations of I-129 in ground and surface water, eastern Snake River Plain, Idaho, 1992 (3)
	11. Geochemistry of the Little Lost River drainage system (3)
	12. Geochemistry of the Birch Creek drainage basin, Idaho (1)
	13. Conceptual mixing model of the Snake River Plain aquifer in the western part of the Idaho National Engineering and Environmental Laboratory, Idaho (1)
	14. Physical characteristics of vent corridors (9)
	15. Ages and accumulation rates of subsurface basalt flows (9)
	16. Evaluation of flood flow characteristics of bedrock constrictions in the Big Lost River downstream of the INEEL diversion (1)
	17. Evaluation of the effects of travel time and channel infiltration losses from tributary sub-basins on flood flows of the Big Lost River (1)

H. GEOHYDROLOGIC STUDIES

Horizontal and vertical migration of solutes in the subsurface, and the resultant dispersion, dilution, sorption, and radioactive decay are a result of complex physical and chemical processes that need to be evaluated. Stresses on the geohydrologic system must be evaluated and monitored to adequately describe the variation in processes and to estimate the sensitivity of waste migration to natural conditions. Most data-collection activities are described in item A, hydrologic monitoring.

Beginning in 1988, a comprehensive long-range study was begun to update the ground-water flow and solute-transport models that were constructed in the early 1970's. Previous models were constructed using several generalizing assumptions that are now being quantified on the basis of data that were collected from the late 1970's to the mid 1990's. These assumptions include (1) the amount and timing of potential recharge to the aquifer from the infiltration of streamflow, (2) the geologic framework of the Snake River Plain aquifer, (3) the hydraulic characteristics of the aquifer, and (4) the geochemical processes. Better definition of these four assumptions is needed to provide a more accurate representation of the processes that take place in the aquifer and their impact on the distribution and migration of radioactive and chemical wastes in the aquifer. Items B through E are the tasks that are being performed to update the model so that more reliable and technically defensible predictions can be made of the future impacts of past waste disposal at the INEEL. A draft conceptual model of flow has been written and technically reviewed. Revisions to the draft are in progress. A steady-state numerical model has been constructed and a transient-flow model is currently being constructed as part of the integration of items B through E.

A. Hydrologic Monitoring

During FY 2002, data will be collected to describe the hydrologic and geochemical conditions and to evaluate effects of waste disposal and other activities at the INEEL on the geohydrologic system. Much of the data will be used to prepare interpretive reports. Recently, the USGS opened the NWIS web system to the public. This system permits public electronic access and retrieval of USGS water data, including INEEL ground water and water quality data. The Website address is http://water.usgs.gov/nwis/. The following data will be collected in 2002:

1. About 272 water samples will be collected from approximately 170 deep and shallow wells and analyzed for selected chemical and radiochemical constituents to aid in the definition of contaminant plumes and water chemistry. Most water samples will be analyzed by the DOE's Radiological and Environmental Sciences Laboratory (RESL), or by the USGS's National Water Quality Laboratory (NWQL) in Denver, Colorado.

   If flow occurs in the Big Lost River and other selected streams, water samples periodically will be collected and submitted to the laboratory for radionuclide and chemical analyses to determine the effect that flow has on the chemistry of ground water beneath the INEEL.

2. About 800 depth-to-water measurements in approximately 200 wells and numerous auger holes will be made during FY 2002 to denote changes in storage and hydraulic gradient in the Snake River Plain aquifer and perched-water systems. Operation of about five continuous recorders will detect short-term water-level fluctuations and identify recharge events.

3. About 350 suites of geophysical logs for wells and boreholes have been interpreted to assist in the definition of the lithologic and hydrologic character of the basaltic rocks and interbedded sediment. Other geophysical logs will be collected and interpreted as new wells are drilled as part of the Environmental Restoration Program.

4. Drilling equipment was upgraded in FY1998 with the acquisition of a Christensen CS-1500 truck-mounted coring rig and a Sullair 900-CFM, 350-PSI air compressor. The drill rig was successfully field tested during late FY1998 with the drilling of two geotechnical core holes through the 110-foot sedimentary interbed at an unsaturated-zone research site south of the RWMC. Additional coreholes were completed to evaluate interbed hydraulic properties at the unsaturated-zone research site. These coreholes also are supporting specialized geophysical investigations including the cross-hole radar tomography study being conducted by the USGS Geologic Division's Branch of Geophysics under separate contract. Interbed cores will be collected from all geotechnical holes drilled by the USGS as part of the study to develop a regional regression model relating grain size to interbed saturated and unsaturated hydrologic properties.

The INEEL Groundwater Monitoring Plan developed by the DOE identified 13 sites at which wells or well clusters were needed to more thoroughly document regional ground-water conditions at the INEEL, to test various modeling hypotheses, and to determine the presence or absence of vertical hydraulic head components in the Snake River Plain aquifer beneath the INEEL. The number of wells completed annually will depend on the cost of specific installations and on other priorities. The priority list for these wells presently includes a cluster at EBR-1 (one drilled in FY 1998 by LMITCO) and a cluster near the TRA. Two wells had been drilled by 1995, one well cluster was completed in 1998, a deep geotechnical hole was drilled during 1999 to provide additional water-quality and water-level monitoring data between the RWMC and CFA. In 2000-2001, two geotechnical holes were constructed at the new INTEC pond site to characterize the unsaturated zone and USGS-128 was constructed to replace a landfill well north of CFA. During FY 2002, corehole USGS-128, north of CFA, will be deepened and USGS-129, at EBR-1, will be completed to improve the understanding of subsurface structural features that control ground-water flow.

5. A historical and statistical analysis of the USGS hydrologic monitoring networks was initiated several years ago. This continuing analysis is designed to support the needs of the USGS modeling program and to evaluate redundancy of measurements.

6. Concern has increased in recent years regarding well security issues as they relate to the protection of the environment and the integrity of the ground-water data set. During FY 2002, USGS will modify wells to accommodate secure, locking caps.

7. A draft report was prepared several years ago to provide a post-audit of previous estimates of background concentrations of I-129 in water from the eastern Snake River Plain. After both authors had retired, problems in data validation were observed, and this report was temporarily delayed pending resolution of these problems. Because the information provided by this report is of value to the overall assessment of the fate and transport of contaminants in the subsurface at the INEEL, additional efforts presently are underway to evaluate the data problems and make the report available. See report H-4.

As shown in Table 6, we estimate that 3.2 direct and indirect FTE's will be required to maintain water-sampling, water-level monitoring, and other activities administered through the hydrologic monitoring program. This program is projected to remain stable through FY 2007 and beyond.

B. Aquifer Recharge

Numerical simulation of the ground-water flow system requires data describing the quantity and distribution of recharge to the aquifer. Recharge can greatly affect the direction of ground-water movement and the configuration of contaminant plumes related to waste disposal. Streamflow records since 1904 at gages on the Big Lost River below Mackay Reservoir were analyzed in 1990 to define the volumes of water that episodically recharge the aquifer. This includes the amounts of water that were diverted into the spreading areas, the infiltration rates along the channel of the river, and the amount that is recharged at the playas. Other sources of episodic recharge, such as diversions onto the INEEL from the Mud Lake area, are being identified and will be quantified to the extent possible. Streamflow records are published in a series of annual reports entitled "Water Resources Data, Idaho". A report describing episodic recharge is planned as part of the numerical modeling efforts.

In June 1999, the USGS initiated a study in which a chemical tracer, detectable in water at 200 parts per trillion, was added to water in the INEEL spreading areas. Monitoring will continue for an indefinite and extended period to determine the contribution of spreading-area recharge to underflow at the RWMC. Small concentrations of the tracer were detected in several perched wells and one aquifer well shortly after the tracer was introduced to spreading-area water. This study was designed, in part, to improve our understanding of recharge related to the spreading areas. Also, see Attachment B for proposal for a new, multiple-tracer test.

Geochemical studies are being used to improve our understanding of recharge at the INEEL. A basic data report, "CFC's, Sulfur Hexafluoride, and Dissolved Permanent Gases in Ground Water from Selected Sites In and Near the INEEL" was released in FY 1999. A second basic data report for this study was released in FY 2001. In 1998, the recharge ages of the young fraction of ground water in the Snake River Plain aquifer at the INEEL were determined using three different dating methods. This report, "Age of Ground Water at the Idaho National Engineering and Environmental Laboratory: Results from Chlorofluorocarbon, Tritium-Helium-3, and Sulfur Hexafluoride", was in preparation for cooperator review at the end of FY 2001.

In the past, the amount of recharge from the infiltration of rainfall, snowmelt, and streamflow has been assumed to be negligible except along the channel of the Big Lost River and INEEL spreading areas. In order to evaluate the validity of this assumption, a small drainage-basin gaging station network study will be continued over the next several years. Three drainage basins range in size from 2 to 20 square miles and are instrumented to measure runoff. The three basins are topographically closed; each contains a terminal playa that will store runoff and allow it to recharge the aquifer. The small drainage-basin network has been designed for long-term data collection with a minimal amount of work effort; most are located in stream-channel reaches that can be rated theoretically. This program was terminated in FY 2001 due to funding reductions and projected additional reductions in FY 2002.

Recharge studies will require 0.2 direct and indirect FTE's (Table 6) annually at least through FY 2007.

C. Geologic Framework

In past years, using data from 333 wells and numerous cores, the USGS developed a detailed stratigraphic database to provide a geologic framework for a variety of facility-scale to INEEL-scale hydrologic investigations. This database was most recently used to develop a conceptual geologic framework for the USGS flow and transport models. Key elements of the conceptual framework, including geohydrologic units 1 and 2, are, in places, uncertain; appear to greatly affect flow and transport; and need to be validated by additional drilling and testing of rock cores. The area of greatest importance is between the INTEC and RWMC. The geologic layers of greatest importance in identification of the boundary between units 1 and 2 are the "F" and "T" basalt-flow groups.

The F basalt flow group underlies much of the southern part of the INEEL at or near the water table. Because this basalt flow group is characterized by reversed paleomagnetic polarity, it is an important marker for evaluating geologic structures that probably affect the movement of water and wastes downgradient of the INTEC. The F basalt, easily detected by measurements of paleomagnetic polarity, is present in cores from seven widely-distributed boreholes. Cores from six of these locations presently are being evaluated for chemical composition. If these cores have different compositions, it would indicate that the structures are most likely related to depositional processes. If the compositions are the same, it will indicate that the structures are most likely related to tectonic processes. The latter interpretation, used in the flow and transport models, has a greater potential to provide preferential pathways and vertical gradients for the movement of water and wastes in the southern part of the INEEL. Additional coreholes at key locations are needed to better define the F basalt and its structural characteristics.

The I basalt also underlies much of the southern part of the INEEL from one to several hundred feet below the water table. Where it has been described in cores and wells at and near the INTEC, it ranges from about 150 to 250 feet thick; is made up of dense, massive basalt; and is characterized by hydraulic conductivities that are several orders of magnitude less than those of the thin, fractured basalt flows that overlie it. As such, the I basalt has the potential to limit the downward movement of water and wastes, thereby confining the wastes to the uppermost few hundred feet of the aquifer between the INTEC and RWMC. The southern extent and geologic structure of the I basalt that are presently used in the flow and transport models were interpreted from borehole geophysical logs. Additional coreholes at key locations are needed to better define the I basalt and its hydraulic and structural characteristics.

About 10 deep coreholes are planned, at a rate of two per year during the next five years, to provide data to validate or modify the present conceptual geologic framework of the INEEL. This includes drilling and testing of the F and I basalt-flow groups at two key locations in the southern part of the INEEL during this fiscal year. Up to two coreholes also may be constructed south of INTEC to provide additional information about the distribution of units 1 and 2, distribution and hydraulic properties of unsaturated-zone interbed units, and to provide support to the INEEL in characterization of I-129 in the H-I interbed.

Differences in the polarity and inclination of remanent magnetization present in the rocks comprising the Snake River Plain aquifer at the INEEL offer the most reliable means of differentiating the basalt flows. Cores from five boreholes are, or will shortly become, available to confirm the southward tilting disposition of the lava flow section represented by Unit 2 in the vicinity of INTEC and CFA. Cores from CFA-LF-3-11 (860 ft), ICPP-SCI-V-213 (560 ft), CPP-185 (500 ft), CPP-186 (500 ft), and USGS 129 (estimated depth = 1200 ft; currently under construction) will be used for the proposed paleomagnetic studies. Approximately 900 samples from the combined 3630 ft of core from these wells will be used to precisely locate the contact separating Unit 1 from Unit 2.

Another geologic study that is scheduled for completion during this fiscal year is the characterization of selected vent corridors. These features are narrow zones of volcanic vents, dikes, and fissures that trend perpendicular to the regional direction of ground-water flow. Vent corridors, which may play a role in the dispersion of liquid wastes, are

characterized by hydraulic conductivities having a range of more than six orders of magnitude over distances of 500 to 1,000 feet. Physical characteristics of several exposed vent corridors have been described in a journal article that is scheduled for publication this year. In addition, hundreds of micromagnetic and microgravity measurements have been taken across one exposed vent corridor south of the INEEL to evaluate if these methods might be used to detect concealed vent corridors underlying the INEEL. Geophysical data analyses and interpretive reports are in progress.

Microgravity methods show promise of imaging geologic structures at depth, and might, in conjunction with drilling and testing of additional cores, help to better define the geologic framework of the southern part of the INEEL. In addition, microgravity also has the potential to describe the spatial and temporal movement of water in the unsaturated zone resulting from episodic recharge from the Big Lost River and the INEEL spreading areas. A recent field test of tracer applied to water in the spreading areas and subsequent monitoring for the tracer in nearby wells showed that water can move rapidly to the aquifer and spread laterally through the unsaturated zone for distances of more than a kilometer. Microgravity may provide better areal coverage of such water movement on a scale that is relevant to the issues of contaminant transport and aquifer recharge at such facilities as the INTEC and RWMC. Separate funding to use microgravity for these applications is being pursued in a collaborative effort by the USGS, BBWI, and Idaho State University.

A study of sedimentary interbeds from selected coreholes within the Big Lost trough, an area of significant sediment accumulation between TAN and the RWMC, was completed last fiscal year. This study was conducted to identify and describe sedimentary facies associated with about a dozen expected sedimentary depositional environments, and to obtain grain-size characteristics and estimates of hydraulic conductivity of each facies for the purpose of evaluating their potential effects on the movement of water in the subsurface. Sedimentary facies range from permeable, coarse-grained channel deposits to much less permeable, fine-grained lake beds. From a hydrologic perspective, the most significant finding of the study is that most sediments within the Big Lost trough consist of poorly sorted mixtures of clay, silt, and fine sand. This finding suggests that most interbeds underlying this part of the INEEL probably retard downward movement of water in the unsaturated zone and form semi-confining layers in the Snake River Plain aquifer.

A detailed stratigraphic framework was developed by the USGS during past years to support facility-scale to INEEL-scale hydrologic investigations. The development of this framework, which was published in 1996 and is being used for many site applications, relied on interpretations made from geophysical logs correlated to the quantitative stratigraphy of a limited number of cores. Most cores used for this framework were evaluated for paleomagnetic properties, petrographic characteristics, and radiometric geologic ages. Since 1996, many additional cores have been obtained, and some of these and previous cores have also been selectively evaluated for basalt geochemistry, a property that has helped to refine the stratigraphy of the southern INEEL in and near areas of past waste disposal. This chemical analysis and resulting improvement in stratigraphy has for the last few years been conducted through a program established by the USGS and Idaho State University to conduct hydrogeologic research in support of selected INEEL waste issues. This program presently is supporting geochemical research of the "F" basalt-flow group, a key marker bed in the subsurface between the INTEC and RWMC. During FY 2002, USGS will support one research assistant and data collection and analysis to better characterize other key basalt flows in this important part of the INEEL. The geochemistry will be used to supplement the acquisition of additional paleomagnetic data.

In addition to these geologic studies, a tool is under development to facilitate public access to previously published stratigraphic data for selected wells at and near the INEEL. This tool consists of an interactive web page showing selected maps and GIS coverages and stratigraphic data for 333 wells.

As shown in Table 6, we estimate that 2.1 direct and indirect FTE's will be required during 2002 and out years to maintain and update the stratigraphic data base, develop the stratigraphic model, and support research coring activities.

D. Water-Rock Interactions

Chemical and radiochemical constituents in ground water at the INEEL are derived from natural and man-caused processes involving reactions between the solid, liquid, and gaseous phases. In order to define these reactions and their impact on waste migration, it is necessary to understand the natural geochemistry of the system. The northern part of the INEEL is situated in a closed topographical depression where rapidly infiltrating surface water mixes with ground water derived from several tributary valleys, from ground water moving into the area from the northeast, and with water upwelling from the deep ground-water system. The water from each of these sources has a different chemistry that is related to the unique water-rock interactions that have taken place throughout its travel history. When these

waters mix, the chemistry of water in the Snake River Plain aquifer at the INEEL is impacted. As this water moves in the Snake River Plain aquifer at and downgradient from the INEEL, the water is further impacted by natural reactions of ground water and the solid-phase matrix of the aquifer, by the characteristics of the ground-water flow system, and by the effects of waste disposal. In order to understand the chemistry of ground water and the transport of solutes in the system, the following tasks are identified:

1. Laboratory column and batch experiments were conducted to determine the impacts of geologic materials on controlling solute migration and to calculate their distribution coefficients. Work on this task has been completed and the results have been published. These data will be useful in constraining input to the solute transport model being developed by the USGS, as well as transport models being developed by other organizations;

2. Develop reaction-path models of ground water in the tributary valleys that recharge the Snake River Plain aquifer. Work has been completed on the Big Lost River system and the results have been published. Work on the Little Lost River and Birch Creek systems is nearly complete and the results should be published in FY02 (see reports H-3 and H-15). Additional work in the Camas Creek and Wood River drainages would be useful if funding becomes available. The results of these studies will be used to develop a conceptual mixing model of the northern part of the INEEL and will be useful in evaluating fluxes used as boundary conditions in the flow and transport models being developed by the USGS and other organizations;

3. Study the natural geochemistry of the Snake River Plain aquifer at the INEEL. Known water-chemistry will be combined with elements of geochemical analysis such as mixing, chemical reactions, and energy state of the system to determine if the assumptions of volumetric fluxes and directions of flow in the conceptual flow model are reasonable. The study will evaluate the effects of mixing recharge waters from various sources with moving ground water. These different sources of recharge impact the water chemistry of the SRPA at various points along the direction of ground-water flow. Several zones of mixing have been identified where the chemistry likely has been impacted (Birch Creek Playa area, Little Lost River/Big Lost River Playa area, Big Lost River Channel/Big Lost River spreading area, and the southeastern INEEL throughflow area). As recharge waters mix with ground water in these areas, the thermodynamic characteristics of the system change and cause reactions to take place, which further changes the natural chemistry of the system. Combining the chemistry and flow in this manner should point out deficiencies in the assumptions of the conceptual flow model and provide a means of estimating changes in volumetric fluxes that will refine the understanding of flow in the SRPA. This study will also provide the basis for more quantitative geochemical modeling of contaminant transport as discussed in item 5. A draft report documenting the results of this study should be completed in FY02 (see report H-16).

4. Develop a local meteoric water line derived from atmospheric precipitation data. The definition of the stable isotopic composition of hydrogen and oxygen in precipitation provides a baseline for comparing similar data derived from ground-water, surface-water, and solid-phase samples collected at the INEEL and vicinity. These comparisons provide a tool for identifying physical and chemical processes that affect the geochemistry of the Snake River Plain aquifer system and for identifying sources of recharge to the system. Data collection was initiated in FY00 and will be completed in FY02. An interpretive report presenting the local meteoric water line will be completed in FY02 (see report H-17);

5. Develop a comprehensive geochemical analysis using the results from items 1-4 and historic waste disposal records to describe the impact of waste disposal at and downgradient from the INEEL. This work item will include reaction-path modeling, modeling of multi-component mixing, and isotope analysis using NETPATH. Other appropriate geochemical tools will also be used in this work item. Results will have direct application to solute transport modeling by the USGS and other organizations, and the results of reaction-path modeling should also help constrain the USGS flow model by evaluating the three-dimensional conceptualization of ground-water flow in the Snake River Plain aquifer system. Numerous data reports presenting geochemical data have been published or are pending publication. The types of geochemical data include water chemistry, mineralogy and solid-phase chemistry of Snake River Plain aquifer materials, stable isotope composition of precipitation, stable-isotope and naturally occurring unstable-isotope composition of water from the Snake River Plain aquifer and surface water, and the distribution of several types of industrial contaminants in the aquifer. Work is ongoing.

The conceptual model of flow in the Snake River Plain aquifer at the INEEL indicates strong structural and stratigraphic controls on migration of contaminants. Independent lines of evidence, including geochemical studies, are essential to verify these controls. Geochemical studies will combine known water-chemistry at the INEEL with elements of geochemical analysis such as mixing, chemical reactions, and energy state of the system to determine

if the assumptions of volumetric fluxes and directions of flow in the conceptual flow model are reasonable. The combination of geochemistry and flow should point out deficiencies in the assumptions of the conceptual flow model and should provide a means of estimating changes in volumetric fluxes that will refine the understanding of flow in the SRPA. This study also will provide the basis for more quantitative geochemical modeling of contaminant transport. For this work, we propose to acquire the consulting services of researchers within the USGS National Research Program who presently are developing state-of-the-art mixing models of chemical transport.

We estimate that 1.2 FTE's will be required for FY 2002 and outyears to water/rock geochemical studies.

E. Hydraulic Properties of the Snake River Plain Aquifer

Hydraulic properties of the aquifer govern the velocity of ground-water movement and the migration of contaminants. Tests conducted at about 80 wells in 1987 and 1988 provided information on aquifer transmissivity, and the hydraulic conductivity of rock units that make up the aquifer. As new wells are drilled, or as pumps are installed in existing wells, additional tests will be conducted to further document the spatial and vertical distribution of the hydraulic properties of the aquifer. During 1988-90, aquifer-test data were analyzed, checked, and tabulated. Analyses included a review of test data collected since the 1950's as well as aquifer-test data collected during 1987-88. In 1991, two reports were published that documented aquifer transmissivity as defined by tests at about 80 wells.

In 1991 and 1992, work was begun to develop a conceptual model of ground-water flow at the INEEL by combining aquifer framework information with hydraulic property information. This work will continue as new data are collected and analyzed. Hydraulic properties determined from this study are being correlated to stratigraphic data in preparation of numerical modeling input files.

Stratigraphic and aquifer-test data are being used to improve estimates of hydraulic conductivity and storage for input to numerical models representing the Snake River Plain aquifer. These hydraulic properties are controlled by basalt layering characteristics, lithology and distribution of sediment, and distribution of vents, dikes, and fissures within volcanic rift zones.

In late FY 1998, a study was initiated to develop a methodology for the field determination of the hydraulic properties of the sedimentary interbeds. This study is described in section II B. In outyears, we anticipate that the results of this study will be used to systematically evaluate the hydraulic properties of the sedimentary interbeds wherever new boreholes are drilled that penetrate these hydrogeologic units. Besides developing methodology and equipment for hydraulic and tracer borehole tests, this research will be directed toward developing a model to predict hydraulic properties from particle size distributions for INEEL sediments with the objective of creating a tool for inexpensive determination of unsaturated-zone hydraulic properties throughout the Snake River Plain. Also, see reports H-5 and H-6.

We estimate that 0.6 direct and indirect FTE's (Table 6) will be required to support this task in FY 2002 and outyears.

F. Calibration of Numerical Models

A two-dimensional numerical solute-transport model of the Snake River Plain aquifer at the INEEL is described in a report that was published in 1974. Recent data indicate that the waste products have not moved as far as was predicted by the numerical model constructed in 1974. Generally, contaminant concentrations are smaller than those predicted by the model. However, during 1983, 1985, and 1986, tritium was detected in samples from wells along INEEL's southern boundary in concentrations similar to those that were predicted for 1980.

To identify boundary conditions for a regional numerical model of ground-water flow at the INEEL, a 1980 three-dimensional flow model of the eastern Snake River Plain was revisited in 1993. In early 1995, an advective transport study was completed that (1) described the compartments in the aquifer that function as intermediate- and regional-flow systems, (2) described pathlines for flow originating at or near the water table, and (3) quantified travel times for water in the aquifer as a result of advective transport. This work is needed to recalibrate or construct sub-regional hydraulic and transport models of the aquifer at the INEEL. The intermediate- and regional-flow compartments, and pathline and traveltime analyses are crucial to identifying the boundary conditions for models of the aquifer at the INEEL.

In late 1995, construction of a 3-dimensional hydraulic model was initiated. This hydraulic model is needed to model advective and solute transport. As part of this study, a draft conceptual model of flow in the Snake River Plain aquifer

in the INEEL subregion was prepared and reviewed internally during FY 2000. This report will be provided for DOE review in the second quarter of FY 2002. See report H-7. Calibrated INEEL-subregion steady-state and transient flow models (reports H-8 and H-9) will be completed in FY 2002. These models will be used to evaluate the sensitivity of transient conditions on flow in the Snake River Plain aquifer and will provide the platform for development of a transport model (H-10) for the INEEL subregion.

We estimate that modeling efforts will require 1.5 direct and indirect FTE's in FY 2002 and outyears (Table 6).

G. Data Bases

Data that are collected as part of USGS studies at the INEEL reside in several databases. These databases include locally maintained paper files and computer databases providing site information, water-level, water-quality, core, geophysical log, and stratigraphic data. They also include nationally accessible Water-Quality and Ground-Water Site Inventory databases. The USGS routinely provides data retrievals to the DOE and its contractors for inclusion in contractor-operated sitewide databases. Recently, the USGS opened the NWIS web system to the public. This system permits public electronic access and retrieval of USGS water data, including INEEL. The address is http://water.usgs.gov/nwis/.

Local data bases are being expanded to include selected water-level and water-quality data collected by INEEL contractors and the State Oversight Program. These data are being reviewed for possible inclusion in the nationally accessible Water-Quality and Ground-Water Site Inventory databases. The water-quality and water-level monitoring database will continue to grow at a steady and predictable rate through FY 2007 and beyond. Maintenance of these databases is projected to require 0.4 direct and indirect FTE's (Table 6) annually. The geophysical log and stratigraphic databases will grow marginally as additional boreholes are drilled. Outyear plans include conversion of these databases to an electronic format for on-line access via the Internet. Data updates will be provided as soon as these are reviewed and approved by the USGS.

H. Reports

Part of the annual budget supports the preparation of hydrologic-data reports and interpretive reports. Data reports provide documentation of field conditions at the INEEL and may include ground-water level measurements, water-quality analyses, or site information. Interpretive reports are prepared to describe the geohydrologic conditions at the INEEL and how those conditions impact, control, or interact with the Snake River Plain aquifer, perched-water bodies, chemical- and radioactive-waste migration, and the geochemical processes in the subsurface. Reports published by the USGS are provided to the DOE and its contractors, and other Federal, State, and local agencies, and the general public upon request. The data and interpretive reports provide information that is critical to the long-term management and utilization of the Snake River Plain aquifer by the INEEL and the State of Idaho. Reports planned for submittal to DOE in FY 2002 for cooperator review are described in table 1. Those reports that were submitted to DOE for cooperator review or were processed after submittal to DOE during FY 2001 are shown in table 2. Reports planned for release during FY 2002 are shown in table 3.

We estimate that reports efforts will require 0.9 direct and indirect FTE's annually (Table 6).

II. ENVIRONMENTAL RESTORATION PROGRAM SUPPORT

A. Federal Facility Agreement and Consent Order

On December 9, 1991, the Federal Facility Agreement and Consent Order was signed by the DOE; the Environmental Protection Agency (EPA), Region 10; and the State of Idaho. The USGS assists DOE, EPA, and the State in implementation of the agreement. The USGS functions as a technical consultant to DOE, EPA, and the State during implementation of the action plan. In this capacity, the USGS conducts an independent review of hydrogeological data submitted by DOE and will provide comments to DOE, EPA and the State of Idaho of its findings, to the extent resources are available. As practicable, the USGS may assist in procuring contracts for hydrogeological services. A key role is to provide the DOE and its contractors with information on the hydrogeology of specific waste-area groups. This includes the collection of geophysical logs at all boreholes and wells drilled as part of the Environmental Restoration Program. The locally available geophysical logging unit represents a savings of $3,000 to $5,000 for each borehole or well logged.

A core library was established by DOE in FY1991 as part of the Environmental Restoration Program. The USGS is responsible for operating the library. Approximately 75,000 feet of drill core and 9,000 feet of drill cuttings presently

are in the core library. It is anticipated that ten to twenty thousand feet more of core will be collected in the next 5 to 10 years as part of the work associated with characterization and remediation at the INEEL. The library provides a centralized area to store existing and future core. The core library serves two primary functions: (1) to provide a secure storage and analysis area for the core, and (2) to make core available for site-wide and site-specific characterization that will be needed for future facilities and the Environmental Restoration Program. In FY 1999, additional space was identified and prepared at the Central Facilities Area to permit interim core storage expansion. This additional facility is expected to provide for core-storage requirements for the next several years. However, additional long-term storage space needs to be identified or constructed to accommodate future planned drilling activities and to maintain this valuable scientific resource.

The cores are being catalogued in a database. At a minimum, the following information is being recorded: (1) location and unique identifier for the well or borehole from which the core was obtained, (2) altitude of the land surface at the well or borehole, (3) the interval cored, (4) general rock types included in the core, (5) identification of those parts of a core that have been destructively analyzed, (6) a record of the types of analyses that have been performed on selected sections of the core, (7) a reference for the publication in which analyses are contained, and (8) whether the core has been stored in a secured area since its collection. A chain of custody has been established for selected core from the time of collection to its storage in the library. A record also is maintained of those persons that examine or analyze the core.

We estimate that 5.6 direct and indirect FTE's are required annually (Table 6) to continue logging, core library, and technical consultation tasks related to the Federal Facility Agreement and Consent Order.

B. Subsurface Studies at the Radioactive Waste Management Complex (RWMC)

Studies were conducted at the RWMC during 1985-99 to define the extent of radionuclide- and chemical-solute migration and the physical and chemical processes that take place in the shallow surficial sediments. In 1985, the USGS and DOE contractors initially constructed and instrumented the test-trench facility immediately north of the RWMC to describe the hydraulic and solute-transport characteristics of the unsaturated zone underlying the RWMC. A simulated waste trench adjacent to the east test trench was installed in 1988 to define the movement of water in disturbed material. The installations were designed to provide information on the net downward flux of water through the surficial material at the RWMC. The test trenches were instrumented to collect information for calculation of hydraulic properties of the surficial deposits. Additionally, vertical neutron moisture-meter access holes were constructed to provide soil-moisture content data as a function of depth and position within the test trench area. A micrometeorological station at the test trench facility provided atmospheric precipitation data to compute evapotranspiration. Data collection at the test-trench facility is complete, with the publication of the last of five planned data reports in early FY 2001.

A series of laboratory and field experiments and modeling investigations initiated at the test trench facility in 1991 assessed the hydraulic properties of both disturbed (waste-trench) and undisturbed soil materials. These investigations included minimal-disturbance core sampling, laboratory property measurements, analysis of soil profiles with respect to natural and disturbed layering and macropores, field experiments simulating flood or snowmelt infiltration, and a 2-dimensional, layered, hysteretic unsaturated flow model using the USGS-developed code VS2DT. The numerical model has been developed as a tool for understanding the behavior and contaminant-transport effects of unsaturated flow, based on the measured properties of the subsurface media. Experimental results have been published in a series of USGS reports and in scientific journals. The test-trench area continues to serve as a testing ground for newly developed field instrumentation and techniques to be applied to hydraulic property measurement elsewhere at the INEEL. A substantial advantage of this area is that the surficial sediments here have been extensively characterized in terms of their hydraulic properties, both saturated and unsaturated, to provide a standard of comparison and calibration.

An investigation of hydraulic properties of the sedimentary interbeds within the basalts near the RWMC began in late FY 1998. A major objective is to develop a practical and relatively inexpensive methodology for the determination of the hydraulic properties of the sedimentary interbeds. This study will help to explain the role of interbeds in contaminant transport, especially as related to lateral flow, preferential flow, and impedance of downward flow, perching, and retardation. See report H-6.

The chief emphasis of the lab portion of the interbed study is unsaturated hydraulic conductivity and water retention using the steady state centrifuge method. This method provides accurate hydraulic conductivity measurements over a large range of water contents. Additional measurements may involve a controlled-volume apparatus for determining

unsaturated hydraulic properties with emphasis on high-resolution delineation of the wettest portion of the moisture range, which is of greatest relevance to phenomena related to perching and preferential flow in interbeds. Laboratory measurements have been completed for a set of core samples from the B-C interbed about 1 km south of the SDA.

The laboratory-measured properties are being used as input for developing a model to predict hydraulic properties from particle size distributions for INEEL sediments. The long-range objective is to create a tool for inexpensive determination of unsaturated-zone hydraulic properties throughout the Snake River Plain.

Field experiments will measure interbed hydraulic properties by in situ methods and determine the hydraulic response of the system to controlled inputs of water and tracers. These will combine and adapt various widely used field methods such as the constant-head well permeameter and instantaneous profile methods for soil hydraulic properties. Besides developing methodology and equipment for interbed investigations, these experiments will compare and corroborate lab-measured and theoretically estimated properties, and will provide insight into the types of flow and solute-transport behavior possible.

Numerical simulations of two-dimensional unsaturated flow in and near interbeds will use the measured interbed properties as input. These will be used to design hole and instrument placement for the above-mentioned field experiments, as well as to explore the behavior of water and solutes in the subsurface.

Additionally, a Large-Scale Tracer Test was developed and implemented in June 1999 to assess lateral flow in interbeds, perching, ground-water mounding, and other important phenomena. Large quantities of infiltrating water from seasonal streamflow, flooding, and snowmelts cause episodic large fluxes of water that may entrain contaminants and spread them rapidly. This study has shown that a polyaromatic sulfonate tracer applied to spreading areas A and B can spread laterally within the unsaturated zone to distances greater than 1 km. A long-term sampling program continues to gather subsurface data from the Large-Scale Tracer Test, with hydrologic interpretations and report preparation concurrently. A second Large-Scale Tracer Test, with multiple tracers in the Big Lost River and spreading areas A and B, will be initiated when surface water conditions permit, which may be as soon as spring of 2002. This second test was partially funded through Mod A010 (See attachment B and Section III D), and tracers have been purchased.

We estimate 0.6 direct and indirect FTE's are required to support the sedimentary interbed measurements program and development of the hydraulic property model during FY 2002. Outyear estimates for the RWMC subsurface studies range from 1.1 to 0.7 FTE's (Table 6).

C. Well Rehabilitation

Concern about well security issues has increased over the recent years. Each well provides a potential pathway for contaminants or pathogens to be introduced accidentally or intentionally to the aquifer. Potential contamination threatens not only the quality of ground water but also the integrity of the long-term water-quality data base used to evaluate contaminant migration in the aquifer. Because of these concerns, USGS well rehabilitation efforts during FY2002 will focus on issues relating to well-head protection. Well conditions that may affect environmental security were documented and temporarily repaired during FY2001 sampling visits. Project personnel will be upgrading and permanently repairing these conditions during the fiscal year. Conditions include small holes in casings that could permit contaminant entry, well boxes and caps that need repair or replacement, and other above-ground issues.

Additionally, well rehabilitation activities will include downhole fishing and retrieval projects as identified. Pump replacement will be handled in part through the Project support account. We estimate 0.3 FTE will be needed in FY 2002 and beyond for this activity.

D. Technical Review of the Interim Risk Assessment Analysis for the Radioactive Waste Management Complex WAG 7 13&14 Operable Units

At the request of the DOE, the USGS INEEL Project office initiated an independent technical review of Draft Revision 2 of the "Interim Risk Assessment and Contaminant Screening for the Waste Area Group 7 Remedial Investigation" in July 1998. This review was performed by personnel assigned to the INEEL Project office and six outside researchers from the USGS's National Research Program. The review was completed in early October 1999. This work was funded in July 1998 under Modification No. A006 to Interagency Agreement DE-A107-97ID13556. A draft report was submitted to DOE in early FY 2000. At the request of DOE, this report presently is in preparation for approval as a

USGS Administrative Report. Colleague and editorial reviews of this report were completed in FY 2000. Submission of this report for Director's approval is planned for early FY 2002.

III. SPECIAL HYDROLOGIC STUDIES

A. Magic Valley Water Quality

In 1989, continued public concern about the quality of ground water in the Snake River Plain aquifer downgradient from the INEEL prompted the DOE to expand the offsite ground-water quality monitoring network maintained by the USGS. As a result, the USGS designed a long-term monitoring network to document water-quality conditions in the aquifer between the southern boundary of the INEEL and the Twin Falls-Hagerman area. Ground-water samples are routinely collected from about 55 sites. Each site was initially sampled in 1989. In subsequent years, each site has been sampled on a three-year cycle. Analytical results are presented in a series of annual reports. In 1997, interpretive reports were prepared and approved that compared analytical results for the first three years and that analyzed quality-assurance data collected in this study.

As a continuation of the offsite water-quality monitoring program initiated in 1989 between the southern boundary of the INEEL and the Twin Falls-Hagerman area, 20 water samples will be collected in 2002 and submitted to the NWQL. The samples will be analyzed for radionuclides, nutrients, trace metals, purgeable organic compounds, herbicides, and insecticides. Results of the monitoring program are published in a series of reports. We estimate that 0.2 FTE are required to staff this program on an annual basis.

B. Big Lost River Stream-gaging Stations

In 1984, operation of six continuous and nine partial-record stream gages on the Big Lost River began at the request of DOE to determine transmission losses of the main channel and diversions, to estimate infiltration in ponded areas, and to aid in flood-control studies. Discharge measurements routinely are obtained at the gages to define the relation between the water-surface altitude and the discharge of the streams. The transmission losses and infiltration rates are used to calculate the volume of water that is recharged to the ground-water system. Gaging stations on the Big Lost River are operated by the Idaho Falls *Field Office* of the USGS. Flow records from these stations are published annually. At the request of DOE, telemetry was installed on the gage at Mackay Dam in late FY 1999 to provide downstream INEEL facilities the capability to immediately assess *storage and flow conditions* on the Big Lost River. Additional stream-gaging stations were recommended in an attachment to the FY 2000 and the FY 2001 Task Plans to *provide information* needed to adequately define future flows onto the INEEL. A copy of this proposal is included as attachment A to this Task Plan.

C. Flood Hazard Studies

In FY 2000, the DOE requested the USGS to conduct two studies to better determine the 100-year peak flow of the Big Lost River at the INEEL. Two proposals were prepared and submitted to DOE for approval and funding. See DE-A107-97ID13556 Mods A011, A012, and A013. The purpose and scope of these studies are as follows:

An Evaluation of the Flood Flow Characteristics of Bedrock Construction the Big Lost River Downstream of the INEEL Diversion Structure.—Estimates of the 100-year peak flow, that were derived from a combination of paleohydrologic data and stream gage records, are based in part on the results of a two-dimensional model used to predict flood elevations at different discharges. Current models of flooding in the Big Lost River do not account for scouring of the channel bed during floods. Scouring increases the cross-sectional area and reduces backwater. This study will determine additional amounts of flow due to bed scour at three key bedrock restrictions in the Big Lost River downstream from the INEEL diversion, determine water-level surface elevations due to bed scour, and determine velocities needed to produce incipient motion of channel bed materials. See report H-13.

An Evaluation of the Effects of Travel Time and Channel Infiltration Losses for Tributary Sub-Basins on the Flood Hydrograph of the Big Lost River at Arco, Idaho.—Previous studies estimating the 100-year peak flow and volume of the Big Lost River did not account for the sensitivity of the flood peak to times of travel and channel infiltration. This study will evaluate flood-flow contributions from sub-basins based on field evidence of recent floods, and will determine the effects of travel time and channel infiltration losses on the flood hydrograph for the Big Lost River at Arco. See report H-14.

D. Tracer Studies

In late June 1999, the USGS introduced a polyaromatic tracer (1,5 naphthalene disulfonate) into spreading areas A and B near the RWMC. Monitoring results indicate that water from the spreading areas can move laterally in the unsaturated zone to the subsurface disposal area (SDA) at the RWMC in a relatively short period of time (months). Test results also indicate, that at least locally, vertical movement of water through the unsaturated zone to the water table beneath the spreading areas is very rapid—on the order of a week. Because of the proximity of the spreading areas to the SDA and the large quantities of water that have been and may be diverted into these spreading basins, the influence of the spreading areas on contaminant transport at the SDA needs to be evaluated.

In April 2000, the DOE requested the USGS, in collaboration with the site contractor BBWI, to prepare a proposal for additional tracer studies to begin with the 2000 spring-runoff in the Big Lost River. A proposal to conduct this work was prepared and funded to procure the tracers, however there was insufficient flow in the Big Lost River to conduct the tracer test in FY 2000.

A Large-Scale Tracer Test, with multiple tracers in the Big Lost River and spreading areas A and B, is planned for the spring of 2002. This tracer test was partially funded through Mod A010 (see attachment A) in 2000 to purchase the tracers. A follow-on proposal to conduct these tracer tests in FY 2002 (contingent on additional funding and on the availability of adequate flow in the Big Lost River) is included as Attachment B. Funding for this work is not included in table 5.

E. Special INEEL Studies

Scope: Initiate and conduct miscellaneous special studies at the INEEL as identified and requested by the DOE and its contractors. Such studies shall be within the general scope of the Interagency Agreement in support of characterization studies at the INEEL. A summary of FY 2001 and projected FY 2002 special INEEL studies is shown in table 4. A total of 0.6 FTE is required annually to support this program element.

IV. BUDGET

Program costs for FY 2002-2007 are included in table 5. Personnel requirements are presented in table 6. A detailed breakdown of program costs for FY 2002 is presented in table 7.

Table 4. - Summary of FY 2001 special study activities and projected FY 2001 special study activities

TOPIC	MEETING/ACTION	DATE	COMMENTS
Presentations to the INEEL Citizens Advisory Board (CAB)	Coeur de Alene CAB meeting	9/19/01	USGS gave three presentations describing fate and transport of INEEL-derived contaminants in the Snake River Plain aquifer.
	Idaho Falls CAB meeting	1/15/02	USGS will give a presentation presenting a technical critique of the article "Poison in the vadose zone".
Plutonium Issues	Press Conference	3/14/01	USGS participated in a press conference that presented results of October 2000 plutonium analyses
	Consultation with DOE	Since 9/01	USGS provided numerous technical comments regarding the article "Poison in the vadose zone".
	Consultation with Coalition 21	Since 9/01	USGS provided clarification of results presented in the article "Poison in the vadose zone".
	Press release, Twin Falls Times/News	10/9/01	USGS provided a technical critique of the article "Poison in the vadose zone".
	Press release, Associated Press	10/10/01	USGS provided a technical critique of the article "Poison in the vadose zone".
	Plutonium Training Course	11/6-7/01	USGS presented an overview of plutonium in the environment as part of this DOE-sponsored course.
	Ketchum City Council	12/3/01	USGS will give two presentations presenting a technical critique of the article "Poison in the vadose zone".
	QA/QC practices	Ongoing	USGS provided QA/QC spike actinide samples to samplers, including the site contractor, State, and USGS.
Big Lost River flood hazard analysis	Field Office support for Mods 11 and 12	Sep-Oct/00	USGS prepared permit applications and environmental checklist, and provided staff and equipment to construct 28 trenches in the Big Lost River channel.
	Public workshops	Jun/01, Nov/01	USGS presented technical assessments of the Big Lost River flood hazard analysis.
I-129	Consultation with DOE and its contractor	Ongoing	USGS provided technical assessment of Iodine-129 detections in water from wells near the CFA landfill.
	Proposal preparation	Nov/01	USGS prepared a proposal to analyze archived water samples to fill 1994-2000 I-129 data gaps.
Contacts with local activist groups	Snake River Plain Alliance	3/14/01	Visit re upcoming press conference
	Snake River Plain Alliance, Keep Yellowstone nuclear free	6/7/01	EMS Presentations at University Place concerning activist concerns
	Snake River Plain Alliance, Keep Yellowstone nuclear free	6/19/01	Site tour and plutonium presentation
Technical support	Temperature log study field support of the INEEL contractor	6/01	USGS provided access and support of collection of additional borehole temperature data.
	Water Resources Committee	Monthly	Attendance and technical presentations at these DOE-sponsored meetings.
	Environmental Monitoring Committee	Bi-monthly	Attendance and technical presentations at these DOE-sponsored meetings.
	INEEL Water Board	Monthly	Attendance and participation in the meeting of DOE water managers.
	Reporting of data, consultation with DOE and the site contractor	Ongoing	The USGS provides on a continuing basis technical guidance on the reporting of radiochemical data in a statistically defensible manner.

Table 5. -Program costs for FY 2002 through FY 2007 according to work breakdown structure [Costs are in thousands of dollars]

Investigations by Category	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07
I. GEOHYDROLOGIC STUDIES						
A. Hydrologic Monitoring	362.3	375.3	388.9	402.9	417.4	432.4
B. Recharge	13.3	13.8	14.3	14.8	15.3	15.9
C. Framework	185.2	191.9	198.8	205.9	213.3	221.0
D. Water-rock Interactions	113.6	117.7	121.9	126.3	130.9	135.6
E. Hydraulic Properties	53.1	55.0	57.0	59.0	61.2	63.4
F. Calibration of Numerical Models	139.4	144.4	149.6	155.0	160.6	166.4
G. Data Bases	33.2	34.4	35.6	36.9	38.2	39.6
H. Reports	86.2	89.3	92.5	95.8	99.3	102.9
II. ENVIRONMENTAL RESTORATION PROGRAM SUPPORT						
A. Federal Facility Agreement (FFA)	529.0	548.0	567.8	588.2	609.4	631.3
B. RWMC Studies	50.0	51.8	53.7	55.6	57.6	59.7
C. Well Rehabilitation	31.7	32.8	34.0	35.2	36.5	37.8
D. WAG-7 Interim Risk Assessment Analysis (funded under 1998 taskplan modification A006)	--	--	--	--	--	--
III. SPECIAL HYDROLOGIC STUDIES						
A. Magic Valley Water Quality	114.0	118.1	122.4	126.8	131.3	136.1
B. Big Lost River Gaging Stations (Does not include stations proposed in Attachment A)	79.2	82.0	85.0	88.1	91.2	94.5
C. Flood Hazards	Work funded under 2000 taskplan modifications A011 (funding period Aug 00 - Jun 01) and A012 (funding period Sep 00 - Nov 01)					
D. Tracer Studies	Covered under separate modification to the IA					
E. Special INEEL Studies	52.8	54.7	56.7	58.7	60.8	63.0
Program costs	1843.0	1909.2	1978.2	2049.2	2123.0	2199.6

Note: Costs include a projected 2002 COLA of 4.6%. Outyear cost projections of 3.6% were based on 2000 consumer Price Index and the 2001 COLA and include continuation of the drilling program and costs associated with personnel replacement. Outyear projections also include increases in water-rock interactions to reflect shift in program emphasis.

Table 6. -Personnel Requirements by Fiscal Year, Core Program, FY 2002-2007
[Personnel requirements are in work years. Abbreviations: D, direct; I, indirect]

Personnel (workyears)	FY 02		FY 03		FY 04		FY 05		FY 06		FY 07	
Direct/Indirect	D	I	D	I	D	I	D	I	D	I	D	I
I. GEOHYDROLOGIC STUDIES												
A. Hydrologic Monitoring	2.3	0.9	2.3	0.9	2.3	0.9	2.3	0.9	2.3	0.9	2.3	0.9
B. Recharge	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
C. Framework	2.0	0.1	2.0	0.1	2.0	0.1	2.0	0.1	2.0	0.1	2.0	0.1
D. Water-rock Interactions	1.1	0.1	1.1	0.1	1.1	0.1	1.1	0.1	1.1	0.1	1.1	0.1
E. Hydraulic Properties	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1
F. Calibration of Numerical Models	1.4	0.1	1.4	0.1	1.4	0.1	1.4	0.1	1.4	0.1	1.4	0.1
G. Data Bases	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1
H. Reports	0.7	0.2	0.7	0.2	0.7	0.2	0.7	0.2	0.7	0.2	0.7	0.2
II. ENVIRONMENTAL RESTORATION PROGRAM SUPPORT												
A. Federal Facility Agreement (FFA)	5.1	0.5	5.1	0.5	5.1	0.5	5.1	0.5	5.1	0.5	5.1	0.5
B. RWMC Studies/Interbed Studies	0.5	0.1	1.0	0.1	1.0	0.1	1.0	0.1	0.6	0.1	0.6	0.1
C. Well Rehabilitation	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1	0.2	0.1
D. WAG-7 Interim Risk Assessment Analysis	Technical review completed. Findings to be released as a USGS administrative report early in FY 2001.											
III. SPECIAL HYDROLOGIC STUDIES												
A. Magic Valley Water Quality	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
B. Big Lost River Gaging Stations	Ongoing work performed by Idaho Falls Field Office Personnel											
C. Flood Hazards	Work program performed by Boise District Office Personnel and National Research Program (NRP) as described in proposal (see attachments C and D).											
D. - Tracer Studies	Covered under separate modification to the IA											
E. Special INEEL Studies	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1
TOTAL (Direct/Indirect)	14.8	2.6	15.3	2.6	15.3	2.6	15.3	2.6	14.9	2.6	14.9	2.6
TOTAL	17.4		17.9		17.9		17.9		17.5		17.5	

Table 7. -Detailed budget breakdown for FY 2002 [Costs are in dollars]

Salaries

Employee	Grade/ Step	Hours	Hourly With Benefits	Cost	Remarks
Ackerman	GS13/9	2088	45.65	95,312	Hydrologist
Allen	GS6/5	120	19.58	2,350	Editor
Anderson	GS13/7	2088	41.97	87,624	Hydrologist
Bartholomay	GS12/4	540	37.85	20,442	Hydrologist
Buckmaster	GS9/4	40	25.49	1,020	Editor
Channel	GS12/5	76	34.98	2,658	Editor
Davis	GS11/6	2088	32.41	67,662	Hydrologist
Gilbert	GS8/3	2088	22.94	47,896	Technician
Greene	GS10/7	2028	27.21	55,175	Technician
Helton	GS9/7	112	26.27	2,942	Illustrator
Kemp	GS11/2	626	27.73	17,359	Editor
Knobel	GS13/8	2008	49.54	99,473	Hydrologist
Matson	GS10/10	1760	30.85	54,290	Technician
Orr	GS13/8	1988	44.59	88,647	Hydrologist
Rattray	GS11/5	2028	31.45	63,787	Hydrologist
Roberts	GS8/9	2021	23.81	48,114	Secretary
Rousseau	GS14/6	2008	55.20	110,836	Hydrologist
Tucker	GS10/8	2008	27.98	56,185	Technician
Twining	GS7/1	1976	20.62	35,749	Technician
Wehnke	GS8/1	1990	23.22	46,628	Technician
Replacement technician	GS8/1	1044	23.22	24,243	Technician
Replacement driller	WG5/1	1044	15.36	16,031	Driller
Hickman	GS3/1	1380	10.16	14,016	Clerk (Temporary Student)
*Nimmo	GS14/6	162	Covered in suballocation to NRP		Hydrologist (National Research Program)
*Perkins	GS11/2	750	Covered in suballocation to NRP		Hydrologist (National Research Program)
*Winfield	GS11/2	750	Covered in suballocation to NRP		Hydrologist (National Research Program)
Subtotal Salary & Benefits				**1,058,439**	

Other Personnel Expenses		
Moving expenses	50,000	
Overtime	8,000	
Performance Awards	8,000	
Travel	16,000	
Training	5,000	
Subtotal Personnel Expenses		**87,000**

Operating Expenses			
*Suballocation (IF Field Office)	79,200		Stream gaging network
Laboratory Analyses	76,000		Water-quality samples
Telephone/Cell Phones	3,195		Field telephones
Vehicle Expenses	35,500		Gas, oil, tires, vehicle repairs & maintenance
ADP Expenses	30,000		Intranet fees, licenses, software, software support, hardware
Equipment Maint and Rpr	5,000		Generators, drill rigs, vehicles, trailers, compressors, pumps, forkl
Supplies	38,500		Drilling supplies, field laboratory supplies, standards
Equipment	4,000		Drilling equipment, tools, scientific meters, well measuring tapes
Freight/Shipping, misc	7,785		FED Ex, UPS charges
Working Capital Fund	5,000		Replacement of vehicles, generators, campers, trailers, computers
* Sub-allocation (Geol Div)	24,006		Paleomagnetic analyses of basalt
Payments to other cost centers	1,600		NRC license fee
*Sub-allocation (NRP)	80,000		NRP geochem model, Unsaturated zone hydraulic studies
Contract Services	49,000		Research Assistant positions, Meteoric Water Line contract
Subtotal Operating Expenses		438,786	

Overhead Assessments Rate = 18.47% of net costs (note: calculation excludes entries with asterisk* which already include applicable overhead assessment

Subtotal Overhead Assessments	258,768
Total	1,842,993

ATTACHMENT A
PROPOSAL FOR
ADDITIONAL STREAM GAGING STATIONS ON THE BIG LOST RIVER, LITTLE LOST RIVER, BIRCH CREEK, AND ANTELOPE CREEK

By Nathan Jacobson
USGS Idaho Falls Field Office

Discussions held during the USGS INEEL program review and recent Emergency Preparedness meetings regarding flood hazards have increased the awareness of the lack of coverage or instrumentation at strategic locations in the Big Lost River/ Little Lost River areas. Additional monitoring capabilities are proposed as a result of these discussions. These proposed additions will enable water users and managers to obtain more complete data to assist them in their efforts to quantify surface water recharge in poorly understood areas of the INEEL, to develop an early-alert flood warning capability, to know on a real-time basis when flows are beginning or are at critical stages, and to have available baseline data for future projects that will require substantially greater understanding of ground-water/surface-water interactions than are currently available.

Big Lost River

In an effort to enhance the real-time capabilities of the current system on the Big Lost River, the following additions have been proposed:

1. Install a Data Collection Platform (DCP) on the gaging station on the Installation and operation of DCP at Big Lost River below Mackay Reservoir near Mackay, ID (1312700) to provide real-time data. This site also is crucial to the National Weather Service, who purchased the DCP equipment contingent upon DOE supporting the annual operation and maintenance (O&M) costs. *(This DCP was installed in late FY 1999 and is now a part of the routine stream-gaging program.)*

1. Install a DCP on the gaging station on the Big Lost River above the Big Lost River Sinks (13132565). Although this site is equipped with a continuous recorder, flow is highly unpredictable and the channel is very unstable. Consequently the transducer orifice commonly is above water. This has required estimation of much of the record. This site is critical because it provides data as to how the playas are receiving water.

2. Install a new a gaging station on Antelope Creek near Darlington. In 1997, DOE requested that USGS identify a potential gaging station on Antelope Creek near Darlington. Antelope Creek is a main tributary to the Big Lost River. This inflow below the gage near Mackay and above Arco originates from a large drainage basin and has the potential to contribute greatly to downstream flooding. Any flood flows originating from Antelope Creek will not be picked up until they hit the real-time system at the gaging station at Arco, just outside of the INEEL boundary.

Little Lost River and Birch Creek

A large amount of inflow to the INEEL originates from streams along the northern boundary of the site. The most notable of these are the Little Lost River and Birch Creek.

The nearest gaging station on the Little Lost River is 27 miles upstream at Clyde. A gaging station on the Little Lost River near Howe was operated for several years and was discontinued in 1991.

We propose installing a gaging station on the lower Little Lost River either above or below the town of Howe. This would not replace the gaging station located at Clyde because that station serves the water district and irrigation districts.

Birch Creek has been diverted from its original channel and now flows in a man-made channel to generate electrical power through a bulb turbine power plant. At the power-plant outflow, the creek supplies water to several small diversions and then flows southwest onto the INEEL in a man-made canal. The canal banks of this canal failed in the past two years, releasing flood waters in the vicinity of Test Area North, located in the natural sinks of Birch Creek. This canal then flows west and sinks in an area in the center of the INEEL. This flow is a substantial source of recharge, with a daily mean discharge of approximately 50 cubic feet per second. Presently, the joint USGS/DOE program funds a crest-stage gage on the original channel of Birch Creek on Highway 22. This site probably will not have flow as long as the power plant is being operated.

To correct these situations, the USGS proposes to discontinue the crest-stage gage and to install continuous recording gages with DCP capabilities on the Little Lost River near Howe and the Birch Creek canal.

4. The gage on the Little Lost River near Howe will be equipped with a pressure transducer, Sutron 8210 data logger, and transmitter. It will be installed either above Howe at the old site or at a new site below Howe. This river can be waded at all but the very highest stages. At both locations, local bridges are available for high-flow measurements.

5. The gage on the Birch Creek canal will be located downstream of the Highway 33 crossing. A gage site was located here two years ago with DOE personnel when the canal bank failed for the first time. This site will be equipped with a pressure transducer, Sutron 8210 data logger, and transmitter. This channel can be waded at most stages, but could require a boat measurement during high flows. The culvert crossing does not lend itself very well to a bridge measurement.

The costs for construction and installation (C&I) and operation and maintenance (O&M) for the listed items are as follows:

2. Installation and operation of DCP at Installation and operation of DCP at Big Lost River below Mackay Reservoir near Mackay, ID (1312700). Equipment was purchased by the National Weather Service. Annual operation and maintenance costs are in the FY 2000 task plan budget.

3. Installation and operation of DCP at existing gage Big Lost River above Big Lost River Sinks (13132565).

C&I		
Labor	$714	
Equipment	$5,503	
C&I Total	$6,217	
FY 2000 O&M in addition to normal O&M of existing gage		$1,900
Total C&I and additional annual O&M (FY 2000)		$8,117

4. Installation and operation of gage with DCP on Antelope Creek near Arco, Idaho.

C&I	
Labor	$1,786

Equipment	$6,466	
C&I Total	$8,252	
FY 2000 O&M	$11,390	
Total C&I and annual O&M (FY 2000)		$19,642

5. Installation and operation of gage with DCP on Little Lost River near Howe, Idaho.

C&I		
Labor	$1,786	
Equipment	$6,466	
C&I Total	$8,252	
FY 2000 Annual O&M	$11,390	
Total C&I and annual O&M (FY 2000)		$19,642

6. Installation and operation of gage with DCP on Birch Creek Canal downstream of Highway 33.

C&I		
Labor	$1,786	
Equipment	$6,466	
C&I Total	$8,252	
FY 2000 O&M	$11,390	
Total C&I and annual O&M (FY 2000)		$19,642

ATTACHMENT B
PROPOSAL FOR MULTIPLE-TRACER STUDY, INEEL SPREADING AREAS AND BIG LOST RIVER SPRING 2000

INTRODUCTION

The numerical simulator for flow in the unsaturated and saturated zone at the RWMC does not include provisions for modeling the influence of water diverted into the spreading areas from the Big Lost River (Magnuson and Sondrup, 1998, p.2-30). The spreading areas, located approximately 1500 meters west and south of the RWMC, have been used intermittently since 1965 to regulate flow in the Big Lost River. Earlier investigators have inferred a connection between operation of the spreading areas and flow in the subsurface at the Subsurface Disposal Area of the Radioactive Waste Management Complex as a possibility based on very limited unsaturated-zone but substantial saturated-zone data. However, until recently, data have been lacking to convincingly demonstrate that this direct connection exists. Because of the proximity of the spreading areas to the RWMC and the large quantities of water that have been and may be diverted into these spreading basins, the influence of the spreading areas on flow and contaminant transport at the SDA needs to be evaluated. The validity of the conceptual model of flow and transport at the SDA will remain in question until the issue of spreading area influences is resolved.

To test hypotheses of lateral flow and transport, the USGS introduced a polyaromatic tracer (1,5 naphthalene disulfonate) into spreading areas A and B in late June 1999. Monitoring results indicate that water from the spreading areas can move laterally in the unsaturated zone to the SDA in a relatively short period of time. Test results also indicate that, at least locally, vertical movement of water through the unsaturated zone to the water table beneath the spreading areas is also very rapid and that there may be significant gaps in the interbeds beneath the spreading areas.

Although the amount of lateral flow in the unsaturated zone beneath the RWMC from the spreading areas cannot be quantified on the basis of this single tracer test, the magnitude of these potential fluxes may be a significant component of total flow in the unsaturated zone, and may be much larger than that derived from local precipitation and snow melt. If the 22,000 acre-ft diversion that took place between May 30 and July 2, 1999 is taken as a limiting threshold necessary to initiate lateral flow in the unsaturated zone beneath the RWMC, then the spreading-area diversion record (fig 6-22) suggests that many such events have occurred over the past 35 years.

The 1999 tracer-test results and other supporting information make it very difficult to ignore the possible effects of spreading area influences on contaminant transport beneath the SDA. Without additional evidence, it is not possible to determine how widespread and pervasive lateral flow is beneath the SDA. The USGS, at the request of DOE and in conjunction with BBWX, proposes to conduct a second tracer test during the 2000 spring-runoff period at the INEEL spreading areas to more adequately characterize movement of surface-water recharge in the vadose zone and to identify sources of vadose-zone water beneath the RWMC.

APPROACH

Multiple tracers will be added to water in spreading areas A and B and to channel sediments along a three-mile reach of the Big Lost River. The tracers belong to a family of polyaromatic sulfonate compounds that can be analytically differentiated from the tracer added in 1999. Two of the tracers will be added to water in spreading areas A and B using a boat during normal flood-water diversions. A third tracer will be injected into stream-channel sediments along a reach extending from the INEEL diversion to the Pioneer Ditch diversion. Wells used in the 1999 test and additional WAG-7 wells drilled in the last year will be monitored for the three tracers. This test will be conducted in conjunction with another tracer test planned within the SDA. Sampling efforts will continue at least for the next 12 months.

Tracers. The chemical tracers, normally used in clothing dye processes, are not manufactured in the United States. USGS has been able to locate only one distributor. This distributor, in Hong Kong, obtains the chemicals from manufacturers in mainland China. The great distance and extensive lead time required for delivery requires that these chemicals be ordered as soon as possible. Specific tracers, amounts, and estimated costs are described in the following table.

Tracer	Amount, in Kg	Estimated cost, delivered, dollars
1,5-naphthalene disulfonate disodium	1,000	
2,7-naphthalene disulfonate disodium	1,000	
2-naphthalene sulfonate sodium	1,500	
1,3,6-naphthalene sulfonate trisodium	1,000	
Total	4,500	$50,000

Analyses. Analytical work will be conducted for the USGS by a research laboratory at the University of Utah. Approximately 1,200 samples will be collected by the USGS and BBWX field teams from wells in the vicinity of the RWMC, spreading areas, and Big Lost River. Estimated costs of this work will be $20 per sample for a total of $24,000. These estimates are preliminary and may change as the sampling program evolves.

USGS support. USGS field teams and other support staff will be required to install tracers, and to provide interpretation and analysis of data. Work will be documented in a USGS Water-Resources Investigation report(s).

BUDGET

Cost of the tracers	$50,000 (Already funded through Mod 10, IA DE-A107-97ID13556)
Cost of analyses	$24,000
USGS and BLM support to install tracers	$20,000
National Research Program support staff (interpretation and analysis)	$25,000
Procurement of miscellaneous equipment, Materials, supplies, and rentals	$3,000
Total	$122,000 ($72,000 needed for completion)

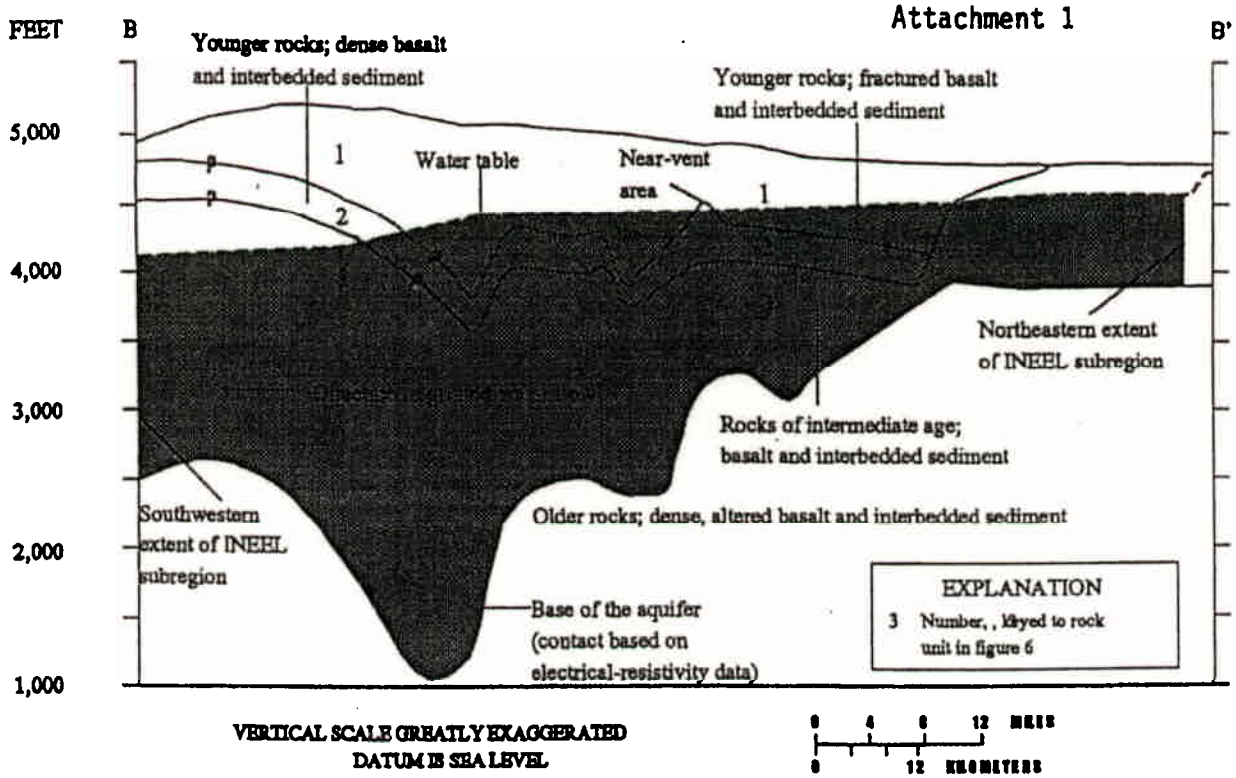

Figure 1. Generalized hydrogeology along the regional direction of ground-water flow within the Idaho National Engineering and Environmental Laboratory subregion.

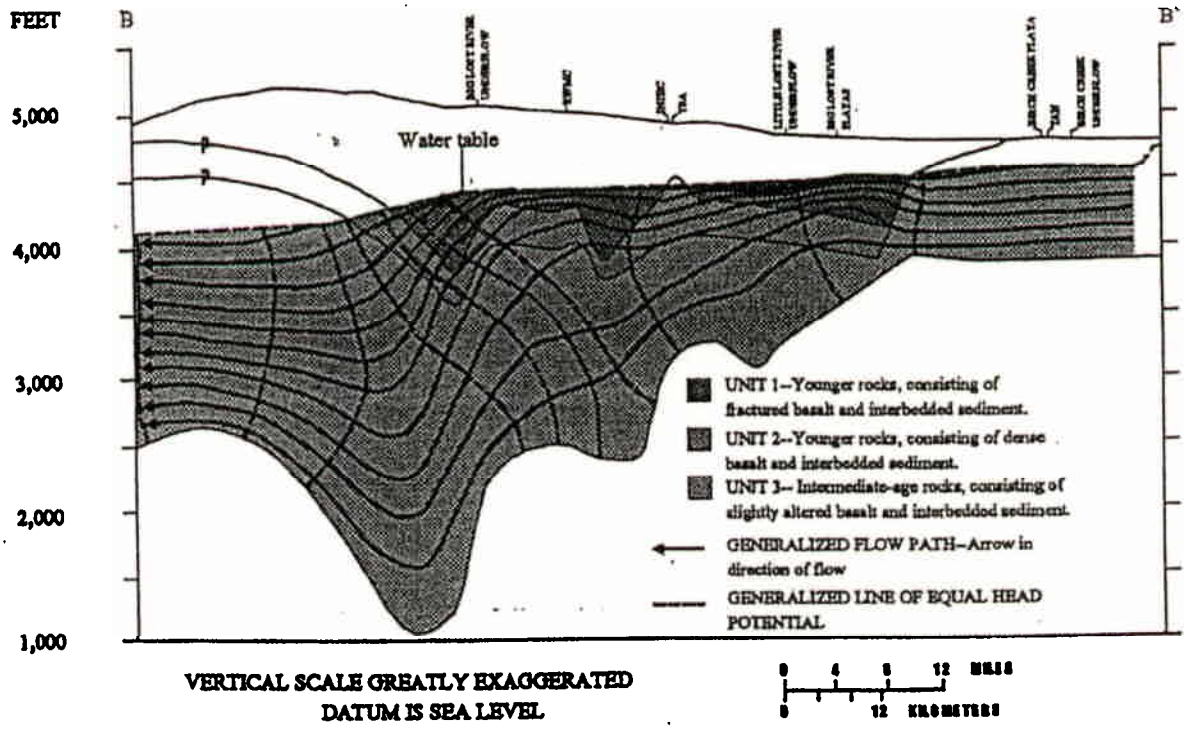

Figure 2. Generalized subregional ground-water flow at and near the Idaho National Engineering and Environmental Laboratory.

U.S. Geological Survey (USGS)
Idaho National Engineering and Environmental Laboratory (INEEL)
PROJECT OFFICE
Statement of Work (SOW) FY02

The U.S. Geological Survey (USGS), Water Resources Division, Idaho National Engineering and Environmental Laboratory (INEEL) Project Office will provide the U.S. Department of Energy, Idaho Operations Office (DOE-ID) support in the following areas: geohydrologic studies, Environmental Restoration Program support, and special hydrologic studies. The background of the USGS program, purpose for each specific task, and estimated costs and resources for future years are included in Joseph P. Rousseau/USGS letter Subject: USGS Task Plan for work to be accomplished in fiscal year 2002, under Contract Number DE-AI07-02ID14307 dated February 4, 2002 (Attachment 1).

The USGS will prepare a quarterly progress report summarizing progress on the major tasks and the funds expended on the project. The report will be submitted to DOE-ID no later than 30 days after the end each calendar quarter.

Task I. Geohydrologic Studies

The USGS will continue to evaluate the horizontal and vertical migration of solutes in the subsurface ground water at and near the INEEL Site, and the resultant dispersion, dilution, sorption, and radioactive decay that occurs as a result of physical and chemical processes. The USGS will continue to evaluate the stresses on the geohydrologic system to estimate the sensitivity of waste migration to natural conditions. The USGS will continue work to refine and validate the conceptual groundwater model, as well as constructing a transient flow model.

I.A. Hydrologic Monitoring

During FY02, the following data will be collected to describe the hydrologic and geochemical conditions and to evaluate effects of waste disposal and other activities at the INEEL on the geohydrologic system:

1. About 272 water samples will be collected from about 170 deep and shallow wells, and analyzed for selected chemical and radiochemical constituents to aid in the definition of contaminant plumes and water chemistry. Most water samples will be analyzed by the DOE-ID, Radiological and Environmental Sciences Laboratory (RESL) or by the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado. If flow occurs in the Big Lost River and other selected streams, water samples will be periodically collected and submitted to the laboratory for radionuclide and chemical analyses to determine the effect the flow has on the quality of ground water beneath the INEEL.

2. About 800 depth-to-water measurements in 200 wells and numerous auger holes will be made during FY02 to denote changes in storage and hydraulic gradient in the Snake River Plain Aquifer and perched-water systems. Operation of about five continuous recorders will detect short-term water-level fluctuations and identify recharge events.

3. In addition to the existing suites of geophysical logs (about 350) for wells and boreholes, other geophysical logs will be collected and interpreted as new wells are drilled as a part of the Environmental Restoration Program.

4. The INEEL Groundwater Monitoring Plan developed by the DOE identified 13 sites at which wells or well clusters were needed to more thoroughly document regional ground-water conditions at the INEEL, to test various modeling hypotheses, and to determine the presence or absence of vertical hydraulic head components in the Snake River Plain Aquifer beneath the INEEL. The number of wells completed annually will depend on the cost of specific installations and on other priorities. The priority list for these wells presently includes a cluster at EBR-1 and a cluster near the TRA. During FY02, corehole USGS-128, north of CFA, will be deepened and USGS-129 at EBR-1 will be completed to improve the understanding of subsurface structural features that control ground-water flow.

5. A historical and statistical analysis of the USGS hydrologic monitoring networks was initiated several years ago. This continuing analysis is designed to support the needs of the USGS modeling program and to evaluate redundancy of measurements.

6. Concern has increased in recent years regarding well security issues as they relate to the protection of the environment and the integrity of the ground-water data set. USGS will modify wells to accommodate secure, locking caps during FY02.

7. A draft report was prepared several years ago to provide a post-audit of previous estimates of background concentrations of I-129 in water from the eastern Snake River Plain. After both authors had retired, problems in data validation were observed, and the final report was temporarily delayed pending resolution of these problems. Because the information provided by the draft report is of value to the overall assessment of the fate and transport of contaminants in the subsurface at the INEEL, additional efforts presently are underway to evaluate the data problems and make the report available

The USGS estimates 3.2 direct and indirect FTE's will be required for task I.A.

I.B. Aquifer Recharge

The USGS will continue monitoring related to the chemical tracer added to water in the INEEL spreading areas. A basis data report for the study on ages of ground water in the Snake River Plain aquifer at INEEL is expected to be released in FY02. The USGS terminated the collection of data from the small drainage-basin gaging-station network.

The USGS estimates 0.2 direct and indirect FTE's will be required for task I.B.

I.C. Geologic Framework

The USGS will examine elements of the conceptual framework, including geohydrologic units 1 and 2. The extent and distribution of these units are, in places, uncertain; appear to greatly affect flow and transport; and need to be validated by additional drilling and testing of rock cores. The area of greatest importance is between the Idaho Nuclear Technology and Engineering Center (INTEC) and Radioactive Waste Management Complex (RWMC). The

geologic layers of greatest importance in identification of the boundary between units 1 and 2 are the "F" and "I" basalt-flow groups.

The F basalt, easily detected by measurements of paleomagnetic polarity, is present in cores from seven widely distributed boreholes. Cores from six of these locations presently are being evaluated for chemical composition. Additional coreholes at key locations are needed to better define the I basalt and its hydraulic and structural characteristics. Approximately two coreholes will be drilled in FY02. Cores obtained from FY02 wells/coreholes will be analyzed to determine structural characteristics. Also, approximately 900 samples from the combined 3,630 feet of core from various other wells will be used to precisely locate the contact separating Unit 1 from Unit 2. Another geologic study that is scheduled for completion during FY02 is the characterization of selected volcanic vent corridors. USGS will support one research assistant and data collection and analysis to better characterize other key basalt flows in this important part of the INEEL during FY02. The geochemistry will be used to supplement the acquisition of additional paleomagnetic data.

In addition to these geologic studies, a tool is under development to facilitate public access to previously published stratigraphic data for selected wells at and near the INEEL. This tool will consist of an interactive web page showing selected maps, Geographical Information System (GIS) coverage, and stratigraphic data for 333 wells.

The USGS estimates that 2.1 direct and indirect FTE's will be required for task I.C.

I.D. Water-Rock Interactions

In order to understand the chemistry of ground water at and downgradient from the INEEL, the following subtasks will be performed:

1. Develop reaction-path models of ground water in the tributary valleys that recharge the Snake River Plain Aquifer;

2. Study the natural geochemistry of the Snake River Plain Aquifer at the INEEL;

3. Develop a local meteoric water line derived from atmospheric precipitation data;

4. Develop a comprehensive geochemical analysis to describe the impact of waste disposal on the geochemistry of water at and downgradient from the INEEL.

The USGS estimates that 1.5 direct and indirect FTE's will be required to complete task I.D.

I.E. Hydraulic Properties of the Snake River Plain Aquifer

The USGS will continue to investigate the hydraulic properties of the aquifer that govern the velocity of ground-water movement and the migration of contaminants. As new wells are drilled, or as pumps are installed in existing wells, additional tests will be conducted to further document the spatial and vertical distribution of the hydraulic properties of the aquifer. Stratigraphic and aquifer-test data will be used to improve estimates of hydraulic conductivity and storage for input to numerical models representing the Snake River Plain Aquifer.

The USGS anticipates 0.6 direct and indirect FTE's will be required for task I.D.

I.F. Calibration of Numerical Models

A report on the draft conceptual model of flow in the Snake River Plain Aquifer in the INEEL subregion will be provided for DOE-ID review in the second quarter of FY02. Calibrated INEEL-subregion steady-state and transient flow models will be completed in FY02. These models will be used to evaluate the sensitivity of transient conditions on flow in the Snake River Plain Aquifer and will provide the platform for development of a transport model for the INEEL subregion.

The USGS anticipates 1.5 FTE's will be required for task I.F in FY02.

I.G. Databases

The USGS will continue to routinely provide data retrievals from its various paper and electronic databases to DOE-ID and its contractors for inclusion in contractor-operated sitewide databases.

The USGS estimates 0.4 direct and indirect FTE's will be required for task I.G.

I.H. Reports

The USGS will prepare hydrologic-data reports and interpretive reports. Data reports provide documentation of conditions at the INEEL and may include ground-water level measurements, water-quality analyses, or site information. Interpretive reports are prepared to describe the geohydrologic conditions at the INEEL and how those conditions impact, control, or interact with the Snake River Plain Aquifer, perched-water bodies, chemical- and radioactive-waste migration, and the geochemical processes in the subsurface. Reports published by the USGS will be provided to the DOE-ID, its contractors, other Federal, State, local agencies, and the general public upon request. Reports listed in tables 1 thru 3 of the USGS 2002 Task Plan will be provided.

The USGS estimates 0.9 direct and indirect FTE's will be required for task I.H.

TASK II. ENVIRONMENTAL RESTORATION PROGRAM SUPPORT

II.A. Federal Facility Agreement and Consent Order (FFA/CO)

The USGS will function as a technical consultant to DOE-ID, Environmental Protection Agency (EPA), and the State of Idaho during the implementation of the Federal Facilities Agreement (FFA) and Consent Order (CO) signed in 1991. In this capacity, the USGS will conduct an independent review of hydrogeological data submitted by DOE-ID and will provide comments to DOE-ID, EPA, and the State of Idaho of its findings, to the extent resources are available. As practicable, the USGS may assist in procuring contracts for hydrogeological services. The USGS will provide DOE and its contractors with information on the hydrogeology of specific waste area groups. This includes the collection of geophysical logs at all boreholes and wells drilled as part of the Environmental Restoration Program.

The USGS will continue to maintain and operate the core and drill cutting library at INEEL. The core library serves to (1) provide a secure storage and analysis area for the core, and (2) make core available for site-wide and site-specific characterization that will be needed for future

facilities and the Environmental Restoration Program. The cores will be catalogued in a database, including (1) location and unique identifier for the well or borehole from which the core was obtained, (2) altitude of the land surface at the well or borehole, (3) the interval cored, (4) general rock types included in the core, (5) identification of those parts of a core that have been destructively analyzed, (6) a record of the types of analyses that have been performed on selected sections of the core, (7) a reference for the publication in which analyses are contained, and (8) whether the core has been stored in a secured area since its collection. Chain of custody records will be maintained, along with a record of those persons that examine or analyze the core and drill cuttings.

The USGS estimates 5.6 direct and indirect FTE's are required for task II.A.

II.B. Subsurface Studies at the Radioactive Waste Management Complex (RWMC)

The USGS will continue with several research projects related to the subsurface at RWMC.

The USGS estimates 1.6 direct and indirect FTE's will be required for Task II.B.

II.C. Well Rehabilitation

The USGS will continue to rehabilitate monitoring wells. USGS well rehabilitation efforts during FY02 will focus on issues relating to well-head protection. Additionally, well rehabilitation activities will include downhole fishing and retrieval projects as identified. Pump replacement will be handled in part through the project support account.

The USGS estimates 0.3 FTE will be needed in FY02 and beyond for this activity.

II.D. Technical Review of Interim Risk Assessment Analysis for the Radioactive Waste Management Complex (RWMC) Waste Area Group (WAG) 7, 13 and 14 Operable Units

At the request of DOE-ID the USGS INEEL Project Office initiated an independent technical review of Draft Revision 2 of the "Interim Risk Assessment and Contaminant Screening for the Waste Area Group (WAG) 7 Remedial Investigation" in July 1998. A draft report was submitted to DOE-ID in FY00. USGS Administrative Report will be sent in to DOE-ID for review and approval in FY02.

III. SPECIAL HYDROLOGIC STUDIES

III.A. Magic Valley Water Quality

As part of the USGS long-term monitoring network to document water-quality conditions in the aquifer between the southern boundary of the INEEL and the Twin Falls-Hagerman area, groundwater samples will be routinely collected from about 55 sites. Samples are taken at each site on a three-year cycle. As a continuation of the offsite water-quality monitoring program initiated in 1989 between the southern boundary of the INEEL and the Twin Falls-Hagerman area, 20 water samples will be collected in FY02 and submitted to the National Water Quality Laboratory (NWQL). The samples will be analyzed for radionuclides, nutrients, trace metals,

purgeable organic compounds, herbicides, and insecticides. Results of the monitoring program will be published in a series of reports.

The USGS estimates that 0.2 FTE are required to staff this program.

III.B. Big Lost River Gaging Stations

The USGS will continue the operation of six continuous and nine partial-record stream gages on the Big Lost River. The USGS, Idaho Falls Field Office will operate gaging stations on the Big Lost River. Flow records from these stations will be published annually.

III.C. Flood Hazard Studies

In FY00, DOE-ID requested USGS to conduct two studies in to better determine the 100-year peak flow of the Big Lost River at the INEEL, (1) An Evaluation of the Flood Flow Characteristics of Bedrock Construction the Big Lost River Downstream of the INEEL Diversion Structure, and (2) An Evaluation of the Effects of Travel Time and Channel Infiltration Losses for Tributary Sub-Basins on the Flood Hydrograph of the Big Lost River at Arco, Idaho. Those studies were continued in FY01. USGS reports for the above investigations will be issued in FY02.

III.D. Tracer Studies

April 2000, DOE requested USGS in collaborate with the site contractor Bechtel BWXT Idaho, LLC (BBWI) to prepare a cost proposal for additional tracer studies to begin with the 2000 spring-runoff in the Big Lost River. A proposal to conduct this work was prepared and funded to procure the tracers, however, there was insufficient flow in the Big Lost River to conduct the tracer test in FY00. A Large-Scale Tracer Test, with multiple tracers in the Big Lost River and spreading areas A and B, was planned in the spring of 2001, but not completed due to lack of flow in the river. Additional tracer work was specified as an attachment to the FY02 Task Plan submitted by the USGS. This work is dependent on the unpredictable flows in the Big Lost River. Therefore, this work will be funded under a separate SOW so the performance period can appropriately accommodate this.

III.E. Special INEEL Studies

The USGS will initiate and conduct miscellaneous special studies at the INEEL as identified and requested by DOE-ID. Such studies will be within the general scope of the Interagency Agreement in support of characterization studies at the INEEL.

SCHEDULE OF AGREEMENT VALUE AND FUNDING OBLIGATIONS

FUNDING	MOD#	Description	Value Adjustment	Cumulative
FY02	A000	FY02 Task Plan	$ 1,000,000.00	$ 1,000,000.00
		FY02 Task Plan ANL-W support	$ 38,000.00	$ 1,038,000.00
		AGREEMENT GRAND TOTAL	$ 1,038,000.00	