

**PROJECT PLAN FOR
THERMOHYDROLOGY PROJECT**

Prepared for

**Nuclear Regulatory Commission
Contract NRC-02-93-005**

Prepared by

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**Revision 3
Change 6**

March 1994

UNCONTROLLED

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

Revision: 3
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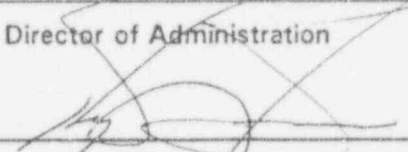
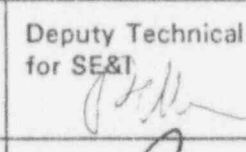
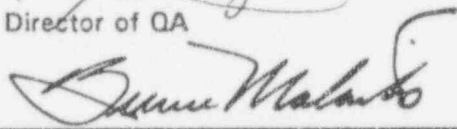
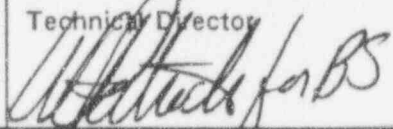
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EFFECTIVITY

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Supersedes: Revision 3, Change 5 - December 1993

Director of Administration 	Date: 3/10/94	Deputy Technical Director for SE&T 	Date: 3/12/94
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CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

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3.2.7 Task 7: Reports and Publications

3.2.7.1 Objective

The objective of this task is to publish the results of research activities performed as part of the Thermohydrology Research Project. This task is designed to support the cost of the preparation and production of this project's input into the CNWRA Semi-Annual and Research Reports, as well as dissemination of information through conference papers and journal publications.

3.2.7.2 Justification

Timely dissemination of information generated by the CNWRA research projects to the scientific community, particularly those in HLW programs, is important because of the time constraints involved in site characterization and other studies leading up to licensing a HLW repository. This information may be useful to scientists and engineers in other programs and can also provide CNWRA investigators with a faster feedback from peers and other potential users regarding their work.

3.2.7.3 Activities

A report on the progress and results of the Thermohydrology Research Project will be prepared twice each year. This report will be incorporated into the CNWRA Semi-Annual and Annual Research Report which will be submitted to the NRC for review prior to publication. Papers will be submitted to conferences and journals as appropriate forums for dissemination are identified.

Recent publications by Green et al. (1992c) and Manteufel et al. (1992) are examples of types of external publication which are being pursued.

A final report summarizing the results of the Thermohydrology Research Project will be prepared. This final report will be externally reviewed by three experts, in the thermal-fluids area. It is expected that the reviewers will be selected from the five reviewers that participated in the peer review of the Thermohydrology Research Project in May of 1992.

3.3 SCHEDULES, MILESTONES, AND DELIVERABLES

The milestones with the schedules for the tasks are shown in the Gantt chart in Figure 3-1. The deliverables in the form of reports are shown in Table 3-1. The first three digits of the milestone number denote the project and task number (e.g., 023 indicates Task 3 of this, the second specific research project); the following three digits identify the specific milestone within the task. In cases where multiple deliverables may be needed to support a single activity, an additional three digits have been added to indicate the sequential number of the deliverable within the activity. Results of research activities conducted under the Thermohydrology Research Project will be reported in the form of semi-annual research reports. Pertinent and relevant technical advances will also be presented at appropriate conferences and workshops and will be published in peer-reviewed technical journals. Upon approval, these milestones and activities will be incorporated into the integrated CNWRA Schedule (see WSE&I Operations Plan).

Table 3-1. List of milestones and completion dates

Milestone Number	Milestone Type	Deliverable Description	Completion Date
027025-001	Major	Final Report	10/25/94
027025-002	Intermediate	Final Peer Reviewed Report	12/30/94

It should be noted that final similarity analysis results depend upon the resolution of such technical issues as matrix/fracture interactions and the establishment of free and forced cells. Resolution of these technical issues is actively pursued within this research project and in the greater technical community. The similarity analysis cannot be completed in its entirety without first resolving these and

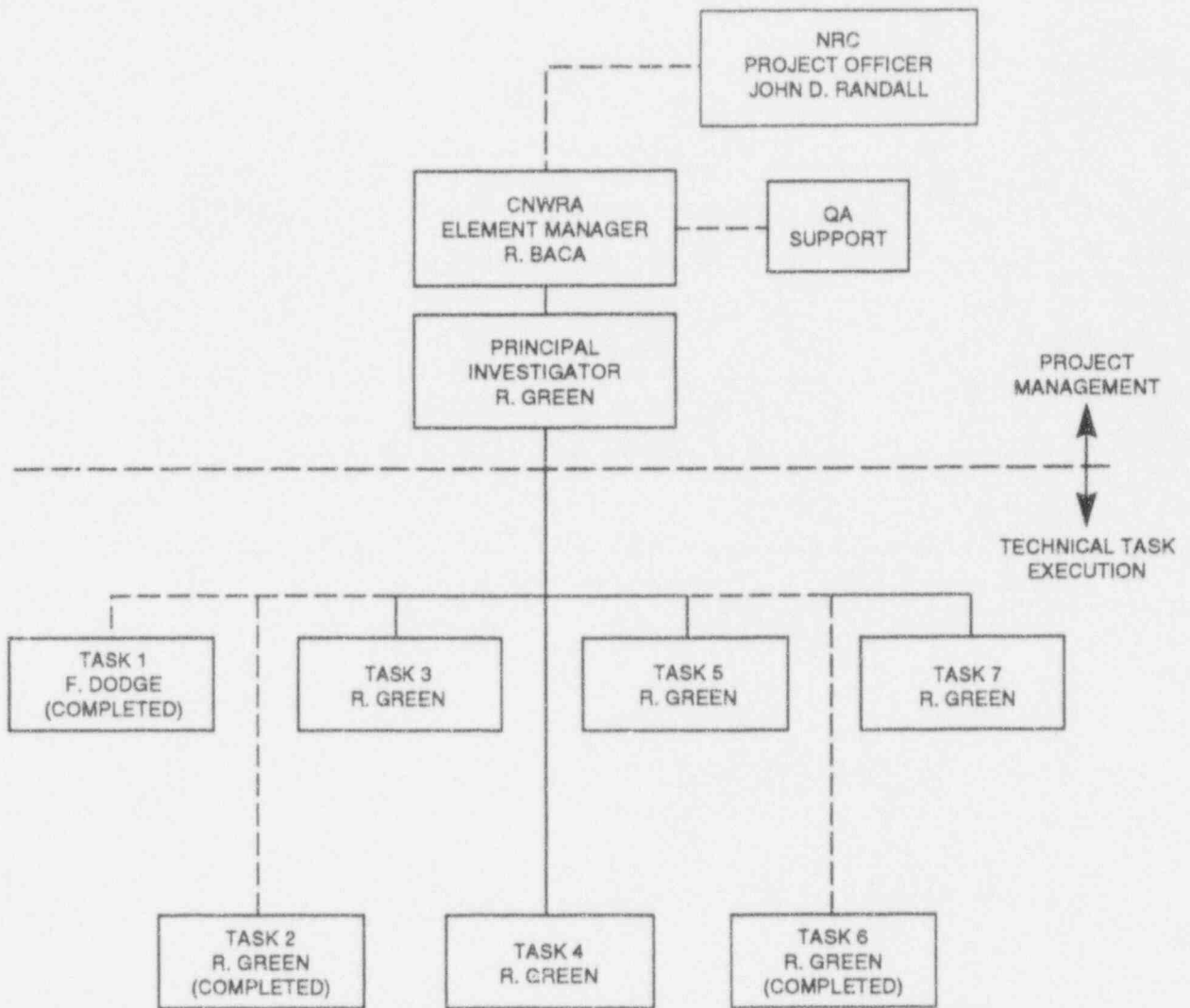


Figure 4-2. Project staff support

Table A-1. Thermohydrology estimated spending plan, FY94

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Center PI-4	459	306	459	459	306	459	306	306	459	306	459	306	459	5,053
Center PI-3	231	116	232	116	232	116	232	116	232	116	232	116	232	2,323
Center PI-2	2,194	2,165	2,165	2,784	2,134	2,196	2,196	2,196	2,196	2,196	2,165	2,165	2,196	28,948
Center PI-1	1,634	1,556	1,641	1,982	1,641	1,598	1,620	1,577	1,620	1,598	1,641	1,556	1,641	21,303
Center Tech	0	0	0	0	0	0	802	802	802	802	802	802	802	5,617
Center Clerical	113	123	113	144	113	123	113	113	123	113	113	123	113	1,541
Center Labor	4,633	4,266	4,611	5,485	4,427	4,493	5,270	5,111	5,433	5,132	5,413	5,069	5,444	64,796
Center Burden	2,025	1,864	2,015	2,397	1,934	1,963	2,303	2,233	2,374	2,243	2,366	2,215	2,379	28,312
Center Overhead	4,461	4,108	4,439	5,281	4,262	4,326	5,074	4,921	5,231	4,941	5,212	4,880	5,241	62,376
SwRI PI-4	778	787	738	1,033	738	787	2,459	2,459	2,459	2,459	2,459	2,459	2,508	22,122
SwRI PI-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI PI-2	2,363	2,355	2,383	2,965	2,383	2,383	2,355	2,411	2,355	2,383	2,383	2,355	2,383	31,459
SwRI PI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI Tech	655	558	577	710	577	577	1,343	1,353	1,343	1,353	1,353	1,343	1,353	13,096
SwRI Labor	3,797	3,700	3,696	4,707	3,698	3,747	6,158	6,222	6,158	6,196	6,196	6,158	6,244	66,677
SwRI Burden	1,659	1,617	1,616	2,057	1,616	1,537	2,691	2,719	2,691	2,707	2,707	2,691	2,729	29,137
SwRI Overhead	6,330	6,168	6,164	7,847	6,164	6,246	10,264	10,372	10,264	10,326	10,326	10,264	10,408	111,145
ADP Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machine Shop	906	906	906	1,133	904	906	906	906	906	906	906	906	906	12,000
Material/Supply	1,132	1,132	1,132	1,416	1,131	1,132	1,133	1,131	1,133	1,132	1,132	1,132	1,132	15,000
Quality Assur.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Report Services	151	151	151	189	150	151	151	151	151	151	151	151	151	2,000
Tphone & Tgram	11	11	11	14	11	11	11	11	11	11	11	11	11	146
Travel	0	2,586	0	2,586	0	2,586	0	2,586	0	2,586	0	2,586	0	15,516
Consultants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cler Prev: Pay	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Svcs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Est exd. CFC, Fee	25,104	26,509	24,743	33,112	24,297	27,199	33,960	36,363	34,352	36,330	34,419	36,062	34,646	407,095
Center CFC	292	269	291	346	279	283	332	322	342	323	341	319	343	4,083
SwRI CFC	433	422	422	537	422	427	702	710	702	706	706	702	712	7,603
Tot Estimate Cost	25,828	27,200	25,455	33,994	24,998	27,909	34,994	37,395	35,397	37,360	35,466	37,084	35,701	418,780
Fee	2,009	2,121	1,979	2,649	1,944	2,176	2,887	3,091	2,920	3,068	2,926	3,065	2,945	33,799
Tot Cost with Fee	27,837	29,321	27,434	36,643	26,941	30,085	37,881	40,486	38,317	40,448	38,392	40,149	38,646	452,579
% Completion	6.15%	6.48%	6.06%	8.10%	5.95%	6.65%	8.37%	8.95%	8.47%	8.94%	8.48%	8.87%	8.54%	100.00%
Cumulative Cost	27,837	57,158	84,592	121,235	148,176	178,261	246,142	256,628	294,944	335,393	373,784	413,933	452,579	
Cumul Completion	6.15%	12.63%	18.69%	26.79%	32.74%	39.39%	47.76%	56.70%	65.17%	74.11%	82.59%	91.46%	100.00%	

A-2

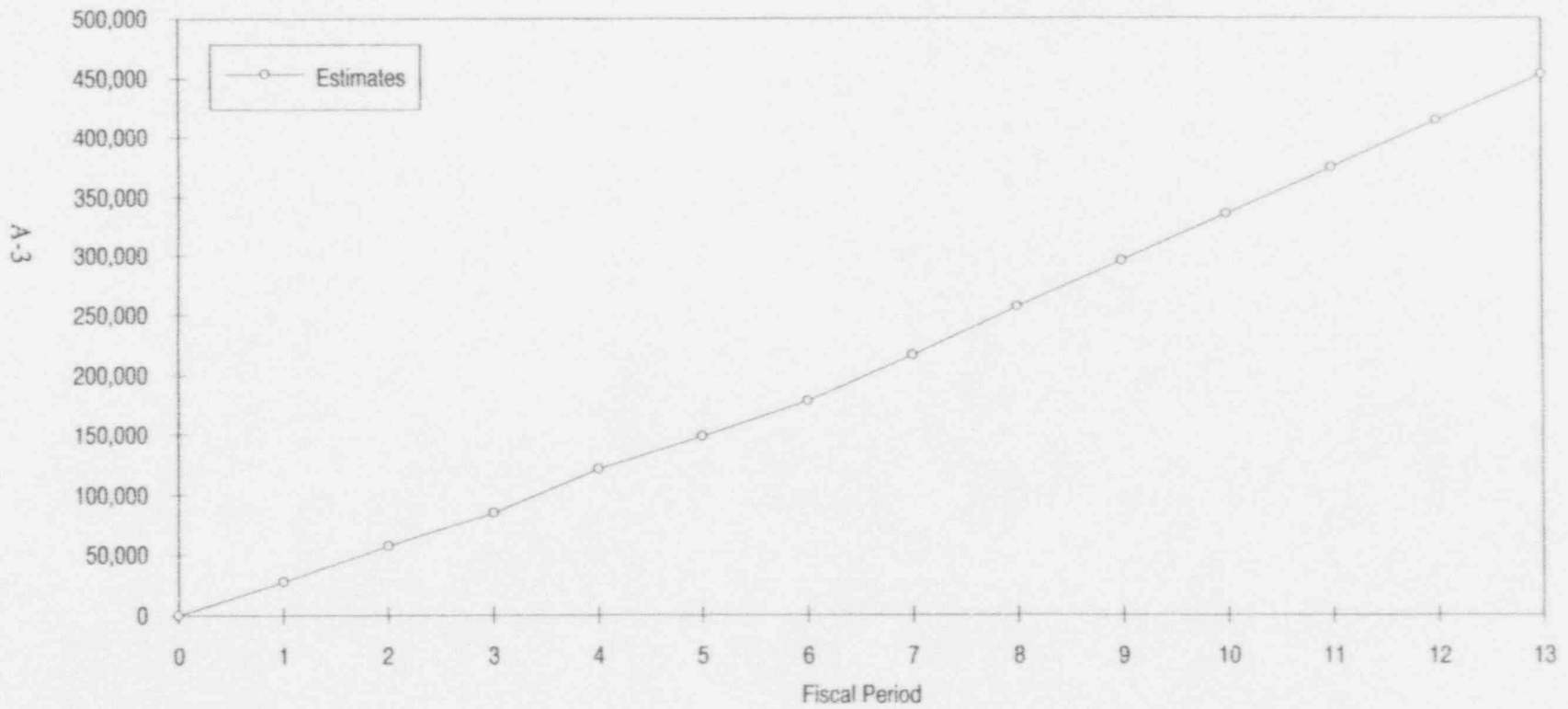


Figure A-1. Thermohydrology estimated spending plan, FY94

Table A-2. Thermohydrology estimated labor plan, FY94

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Center Labor	9	6	9	9	6	6	7	6	6	9	6	9	8	9
Center P1-4	6	3	6	3	6	3	6	6	3	6	3	6	3	6
Center P1-3	71	70	70	90	69	71	71	71	71	71	71	70	70	936
Center P1-2	77	73	77	93	77	75	75	74	76	75	77	73	77	1,000
Center P1-1	9	0	0	0	0	0	80	80	80	80	80	80	80	560
Center Tech	11	12	11	14	11	12	11	11	12	11	11	12	11	150
Center Chemical	174	164	173	209	169	170	250	245	254	246	253	244	254	2,805
Total Center Labor	174	164	173	209	169	170	250	245	254	246	253	244	254	2,805
SwRI Labor	16	16	15	21	15	16	50	50	50	50	50	50	50	450
SwRI P1-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI P1-3	86	85	86	107	86	86	85	87	85	86	86	85	86	1,136
SwRI P1-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI P1-1	61	59	61	75	61	61	142	143	142	143	143	142	143	1,376
SwRI Tech	183	160	162	203	162	163	277	280	277	279	279	277	280	2,962
Total SwRI Labor	183	160	162	203	162	163	277	280	277	279	279	277	280	2,962

Table A-3. Thermohydrology Task 3 estimated spending plan, FY94

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Center PH-4	153	102	153	153	102	153	102	102	153	102	153	102	153	1,664
Center PH-3		39	77	39	77	39	77	39	77	39	77	39	77	774
Center PH-2	1,638	1,639	1,638	2,072	1,638	1,639	1,639	1,639	1,639	1,639	1,638	1,639	1,639	21,650
Center PH-1	976	938	960	1,183	960	959	980	938	960	959	960	938	960	12,782
Center Tech	0	0	0	0	0	0	802	802	802	802	802	802	802	5,617
Center Chemical	113	123	113	144	113	123	113	113	123	113	113	123	113	1,541
Center Labor	2,958	2,841	2,932	3,601	2,881	2,913	3,714	3,633	3,776	3,654	3,735	3,643	3,766	44,048
Center Burden	1,293	1,242	1,281	1,574	1,259	1,273	1,623	1,598	1,650	1,597	1,632	1,592	1,646	19,249
Center Overhead	2,848	2,735	2,823	3,467	2,774	2,806	3,578	3,496	3,635	3,518	3,596	3,598	3,625	42,409
SwRI PH-4	633	638	590	836	590	639	2,311	2,311	2,311	2,311	2,311	2,311	2,361	20,157
SwRI PH-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI PH-2	1,731	1,746	1,746	2,189	1,746	1,746	1,746	1,773	1,746	1,746	1,746	1,746	1,746	23,171
SwRI PH-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI Tech	496	350	359	445	359	359	1,135	1,135	1,135	1,135	1,135	1,135	1,135	10,225
SwRI Labor	2,771	2,735	2,696	3,470	2,696	2,745	5,192	5,220	5,192	5,192	5,192	5,192	5,242	53,535
SwRI Burden	1,211	1,195	1,176	1,516	1,176	1,199	2,269	2,281	2,269	2,269	2,269	2,269	2,291	23,395
SwRI Overhead	4,619	4,559	4,493	5,784	4,493	4,575	8,655	8,701	8,655	8,655	8,655	8,655	8,737	89,238
ADP Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machine Shop	755	754	755	944	754	755	755	754	755	755	755	754	755	10,000
Material/Supply	755	754	755	944	754	755	755	754	755	755	755	754	755	10,000
Quality Assur.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Report Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Telephone & Tigram	11	11	11	14	11	11	11	11	11	11	11	11	11	146
Travel	0	2,586	0	2,586	0	2,586	0	2,586	0	2,586	0	2,586	0	15,516
Consultants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clear Prim Pay	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Svc	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Est. excl. CFC, Fee	17,220	19,412	18,924	23,900	16,799	19,617	26,552	29,026	26,599	26,944	26,600	28,965	26,827	307,536
Center CFC	186	179	185	227	182	184	294	229	238	230	235	230	237	2,776
SwRI CFC	316	312	307	396	307	313	592	595	592	592	592	592	596	6,104
Tot Estimate Cost	17,722	19,903	17,416	24,523	17,288	20,114	27,378	29,951	27,529	29,816	27,427	29,787	27,962	316,416
Fee	1,378	1,553	1,354	1,912	1,344	1,569	2,257	2,467	2,269	2,464	2,261	2,462	2,280	25,572
Tot Cost with Fee	19,100	21,456	18,770	26,435	18,632	21,683	29,635	32,318	29,798	32,280	29,688	32,249	29,942	341,987
% Completion	7.17%	6.27%	5.49%	7.73%	5.45%	6.34%	8.67%	9.44%	8.71%	9.44%	8.68%	9.43%	8.76%	100.00%
Cumulative Cost	19,100	40,556	59,326	85,761	104,353	126,076	155,711	188,029	217,828	250,108	279,796	312,045	341,987	
Cumulative % Completion	7.17%	11.80%	17.35%	25.06%	30.53%	36.87%	46.53%	54.96%	63.69%	73.13%	81.81%	91.24%	100.00%	

Table A-4. Thermohydrology Task 5 estimated spending plan, FY94

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Center PI-4	153	102	153	102	153	102	102	102	153	102	153	102	153	1,684
Center PI-3	77	39	77	39	77	39	77	39	77	39	77	39	77	774
Center PI-2	463	464	464	588	464	464	464	464	464	464	464	464	464	6,185
Center PI-1	488	469	490	597	490	490	469	490	469	490	490	469	490	6,391
Center Tech	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Center Clinical	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Center Labor	1,182	1,074	1,185	1,376	1,134	1,146	1,112	1,126	1,163	1,095	1,185	1,074	1,185	15,035
Center Burden	517	469	518	601	496	501	466	492	508	478	518	469	518	6,571
Center Overhead	1,138	1,034	1,141	1,325	1,091	1,103	1,071	1,064	1,120	1,054	1,141	1,034	1,141	14,476
SwRI PI-4	145	148	148	197	148	148	148	148	148	148	148	148	148	1,965
SwRI PI-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI PI-2	632	610	637	776	637	637	610	637	610	637	637	610	637	8,308
SwRI PI-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI Tech	249	208	218	265	218	218	208	218	208	218	218	208	218	2,869
SwRI Labor	1,026	965	1,002	1,237	1,002	1,002	965	1,002	965	1,002	1,002	965	1,002	13,142
SwRI Burden	448	422	438	541	438	438	422	438	422	438	438	422	438	5,743
SwRI Overhead	1,711	1,609	1,671	2,063	1,671	1,671	1,609	1,671	1,609	1,671	1,671	1,609	1,671	21,907
ADP Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machine Shop	157	151	151	199	151	151	151	151	151	151	151	151	151	2,000
Material/Supply	377	378	377	472	377	377	378	377	378	377	377	378	377	5,000
Quality Assur.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Report Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Telephone & Tgram	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Travel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consultants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clear Prem Pay	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Svcs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Est Incl. CFC, Fee	6,550	6,102	6,483	7,865	6,359	6,390	6,195	6,341	6,317	6,267	6,483	6,102	6,483	83,674
Center CFC	75	88	75	87	71	72	70	71	73	68	75	68	75	948
SwRI CFC	117	110	114	141	114	114	110	114	110	114	114	110	114	1,499
Total Estimate Cost	6,741	6,279	6,671	8,032	6,545	6,576	6,375	6,527	6,500	6,450	6,671	6,279	6,671	86,319
Fee	524	488	519	624	509	511	527	536	537	533	551	519	551	6,931
Total Cost with Fee	7,265	6,767	7,190	8,657	7,054	7,087	6,901	7,066	7,037	6,983	7,223	6,798	7,223	93,250
% Completion	7.81%	7.26%	7.71%	9.28%	7.56%	7.69%	7.40%	7.58%	7.55%	7.49%	7.75%	7.29%	7.75%	100.00%
Cumulative Cost	7,265	14,032	21,223	29,879	36,933	44,030	50,921	57,987	65,034	72,007	79,230	86,028	93,250	93,250
Cumulative Completion	7.81%	15.05%	22.76%	32.04%	39.61%	47.21%	54.61%	62.16%	69.79%	77.22%	84.96%	92.25%	100.00%	100.00%

Table A-5. Thermohydrology Task 7 estimated spending plan, FY94

	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Center P1-4	153	102	153	102	102	153	102	102	153	102	153	102	153	1,684
Center P1-3		39	77	39	77	39	77	39	77	39	77	39	77	774
Center P1-2	93	62	93	124	62	93	93	62	93	93	93	62	93	1,114
Center P1-1	170	149	170	192	170	149	170	149	170	149	170	149	170	2,131
Center Tech	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Center Chemical	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Center Labor	493	352	494	507	412	434	443	352	494	383	494	352	494	5,703
Center Burden	215	154	216	222	190	190	194	154	216	167	216	154	216	2,492
Center Overhead	475	338	475	488	397	418	426	339	475	369	475	338	475	5,491
SwRI P1-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI P1-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI P1-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI P1-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI Tech	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI Labor	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI Burden	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SwRI Overhead	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ADP Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machine Shop	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials/Supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quality Assur.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Report Services	151	151	151	189	150	151	151	151	151	151	151	151	151	2,000
Telephone & Tgram	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Travel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consultants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clear Print Pay	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Svcs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Est incl. CFC, Fee	1,334	996	1,336	1,407	1,138	1,192	1,214	996	1,336	1,070	1,336	996	1,336	15,685
Center CFC	31	22	31	32	26	27	28	22	31	24	31	22	31	359
SwRI CFC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Estimate Cost	1,365	1,018	1,367	1,439	1,164	1,219	1,242	1,018	1,367	1,094	1,367	1,018	1,367	16,045
Fee	107	80	107	113	91	95	103	85	114	91	114	85	114	1,297
Total Cost with Fee	1,472	1,097	1,474	1,551	1,256	1,315	1,345	1,102	1,481	1,185	1,481	1,102	1,481	17,341
% Completion	8.51%	6.32%	8.59%	8.94%	7.24%	7.56%	7.75%	6.36%	8.54%	6.82%	8.54%	6.36%	8.54%	100.00%
Cumulative Cost	1,472	2,569	4,043	5,594	6,850	8,165	9,510	10,612	12,093	13,277	14,758	15,860	17,341	
Current Completion	8.51%	14.82%	23.32%	32.26%	39.50%	47.06%	54.84%	61.19%	68.73%	76.56%	85.10%	91.46%	100.00%	