State of Connecticut

Department of Environmental Protection

Job Analysis Study for Licensed Environmental Professionals

January 1997

prepared by

COLUMBIA ® ASSESSMENT SERVICES, INC.

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PREFACE

During 1996, the State of Connecticut - Department of Environmental Protection (CT-DEP) and Columbia Assessment Services, Inc. (CAS) conducted a job analysis study to identify the primary tasks performed by licensed environmental professionals (LEPs). The fundamental purpose of this study was to establish and validate appropriate content areas for the CT-DEP environmental professionals licensure examination. This job analysis study provides a comprehensive analysis of the work that licensed environmental professionals perform. The analysis was reviewed and validated by a representative group of licensed environmental professionals in the State of Connecticut.

The job analysis study is an integral part of ensuring that an examination is content valid—that the aspects of the environmental protection profession which are covered on the examination are reflective of the tasks performed in an actual practice setting. The study focused on which tasks are performed on the job, how important the tasks are, how frequently the tasks are performed, and how critical the tasks are.

The job analysis study consisted of the following stages:

I. Seven technical advisors developed the major content areas (domains) essential to the performance of an environmental professional.

II. The technical advisors developed tasks, knowledge, and skills inherent in the domains previously defined.

III. An independent review and validation of the technical advisors' domains, tasks, knowledge, and skills by a large percentage of licensed environmental professionals in the State of Connecticut.

This report lists the results of the environmental professionals job analysis process, from conception by the technical advisors to validation by respondents on the statewide survey.

INTRODUCTION

The development of a defensible licensing examination involves more than the writing of questions. Before a content-valid examination may be developed, a licensing organization must determine what skills and knowledge are needed to be a competent professional in that field. To determine competencies, a job analysis, which serves as a blueprint for examination development, is required The job analysis also determines the type of examination, such as written or practical, to be developed in order to assess competence.

Examination specialists, or psychometricians, must follow certain logically sound and legally defensible procedures for developing examinations. These principles and procedures are outlined in manuals such as *Guidelines for Employee Selection Criteria*, prepared by the Equal Employment Opportunity Committee in 1977, and *Standards for Educational and Psychological Testing*, published by the American Psychological Association in 1985. CAS adheres to these standards in developing examinations for licensing programs, including the CT-DEP Environmental Professional Licensing Program.

The most important reason for conducting a job analysis is to ensure a test is content valid. In psychometric terms, validation is the way a test developer documents that the competence to be inferred from a test score is actually measured by the items in that examination. A content-valid examination, then, appropriately evaluates knowledge or abilities required to function as a competent practitioner in the field being tested. Content validity is the most commonly applied and accepted validation strategy utilized in establishing certification and licensing programs today.

One of the major functions of the CT-DEP Environmental Professional Licensing Program is to protect the public from the incompetent practitioner. By selecting a licensed environmental professional, the public is given assurance that the practitioner has met specific criteria designed to ensure that he or she is competent. The technical advisors and the validation study participants considered only the licensed environmental professional when delineating the profession.

PHASE I
INITIAL DEVELOPMENT AND EVALUATION

The first steps in studying the environmental profession were the identification of the major task areas or domains, the listing of tasks performed under each domain, and the identification of the knowledge and skills associated with each task. The following steps were undertaken to achieve Phase I:

I. CT-DEP assembled 7 technical advisors who are subject matter experts in the field of environmental protection to discuss the role of licensed environmental professionals. The technical advisor team, led by James P. Henderson, Ph.D. of CAS, represented a variety of demographic settings and were representative of the State of Connecticut.

   The technical advisors determined that the work of LEPs could be classified into five major content areas, or domains. These domains are:

   1. Site Characterization and Interpretation
   2. Remedy Selection and Implementation
   3. Performance Evaluation
   4. Verification
   5. Professional Responsibility

II. The technical advisors next delineated the tasks in each of the five domains performed by licensed environmental professionals and generated a list of knowledge and skills required to perform each task. CAS staff members subsequently provided psychometric editing of the tasks and knowledge and skill statements.

III. After the technical advisors reviewed and edited each domain and task, CAS prepared the information in survey form to be reviewed and validated by the LEP population in Connecticut. The information collected in this survey is included in the next section of this report.

PHASE II
VALIDATION STUDY

Questionnaire Design and Distribution

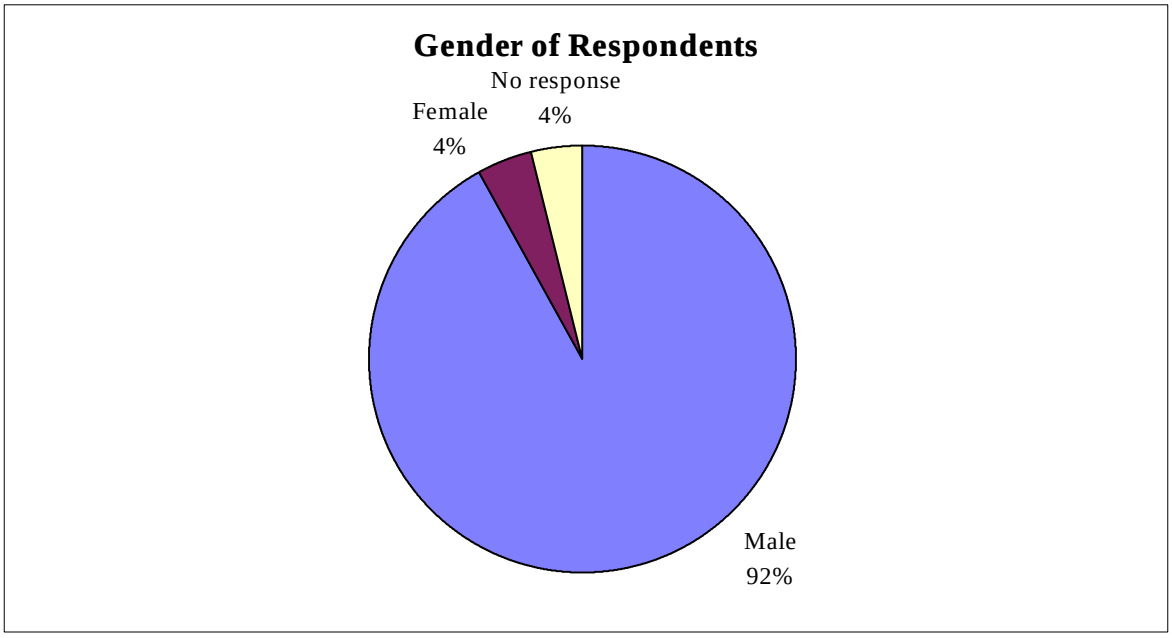
CAS developed a 16-page questionnaire which was distributed to 185 environmental professionals to evaluate, validate, and provide feedback on the technical advisor's domain and task list. The survey was distributed to the entire population of LEPs in Connecticut and a small number of other individuals selected by the CT-DEP. The questionnaire solicited biographical information from the respondents in order to document their qualifications as subject matter experts. This information helped provide verification that the sample represented all major job functions. Of the 185 questionnaires mailed, 73 usable responses were returned to CAS. This amount represents a 39% return rate.

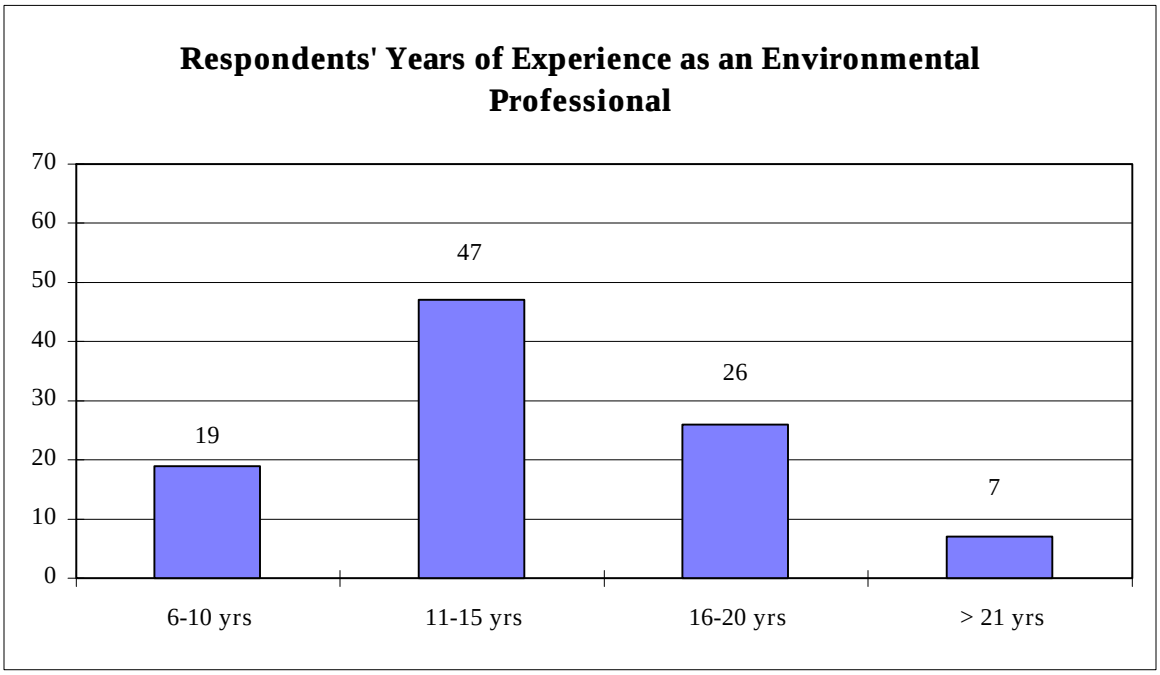
Who Responded to the Survey?

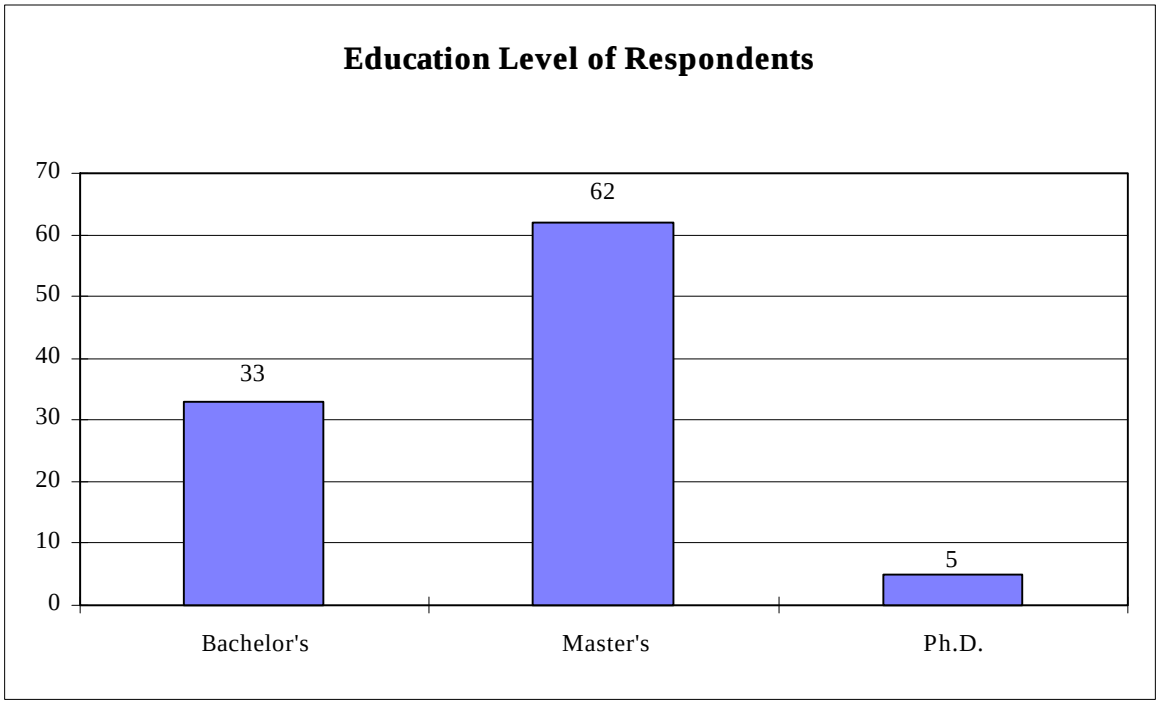
As reflected in the biographical data and graphs below and on the following pages, the survey respondents represent various demographic groups from a variety of practice settings and academic backgrounds. While the respondent population is diverse, one hundred percent of those responding are LEPs. Ninety-two percent of respondents are male and 4% are female. The respondents' ages ranged from 32 to 61, with an average age of 41 years (standard deviation = 8.32).

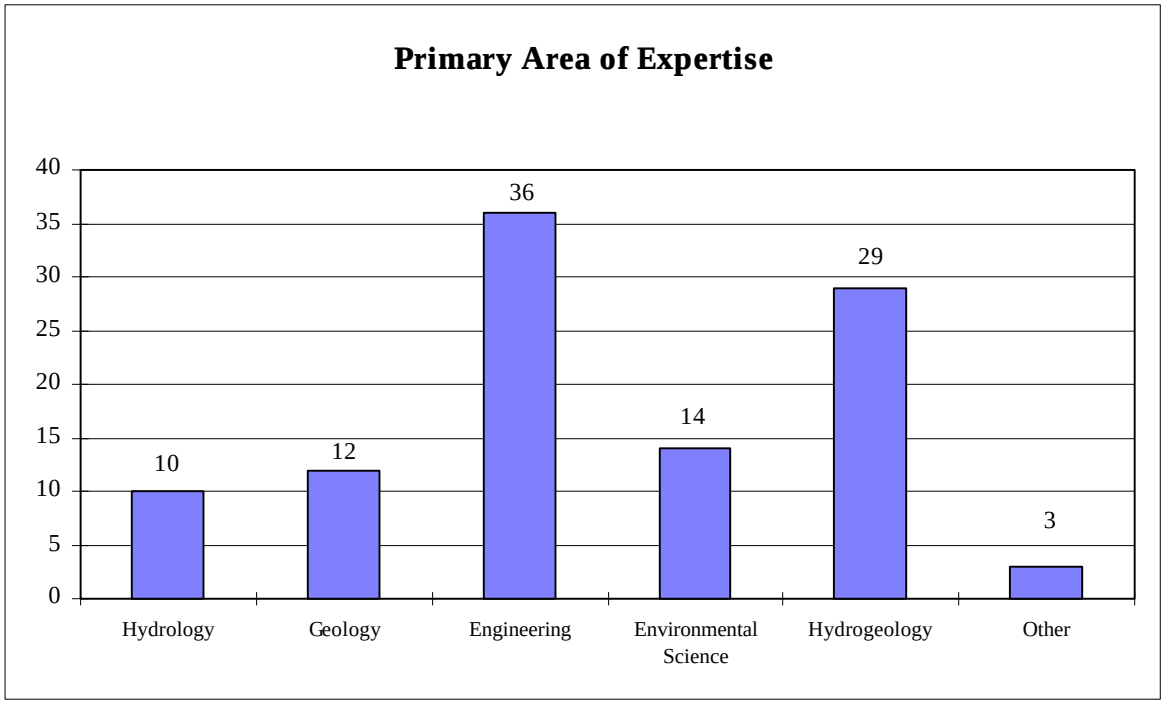
Most of the respondents (62%) have a master's degree, while 33% have a bachelor's degree, and 5% have a doctorate. Most respondents' primary area of expertise was in engineering (36%) or hydrogeology (29%); however, the fields of study are diverse. Other primary fields of expertise for the respondents are environmental science (14%), geology (12%), and hydrology (10%).

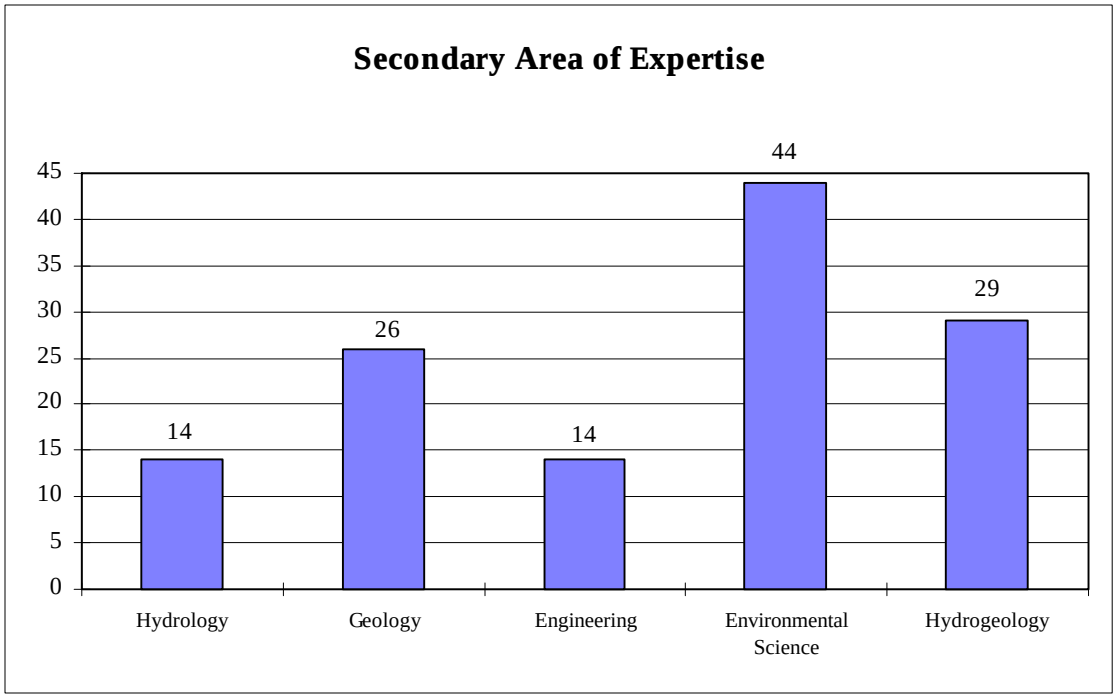
More than half of the respondents are employed in the State of Connecticut (56%), with 32% of the respondents employed in Hartford county and 10% in Fairfield county. Regardless of their place of employment, nearly all (99%) of the respondents are employed in the private sector. Of those employed in the private sector, nearly all (98%) describe their place of employment as a consulting organization. Forty-seven percent of the respondents have between 11 and 15 years of experience as an environmental professional, 26% of the respondents have 16 to 20 years of experience, 20% have 6 to 10 years of experience, and 7% have 21 or more years of experience. Approximately half of the respondents (45%) describe their job title as project manager and another 40% of the respondents hold the job title of principal/associate. Respondents spend 70% of their average work day performing duties related to the investigation and/or remediation of soil and groundwater contamination while these same respondents have an average of 13 years of experience performing these tasks.

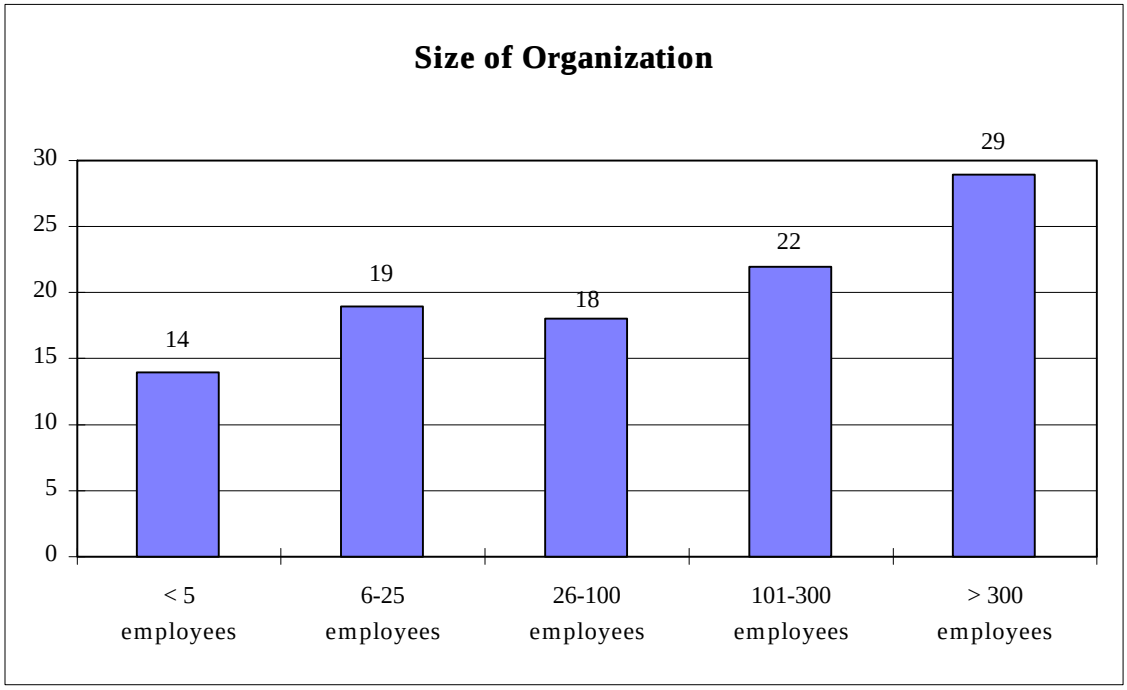

Gender of Respondents
No response
4%
Female
4%
Male
92%

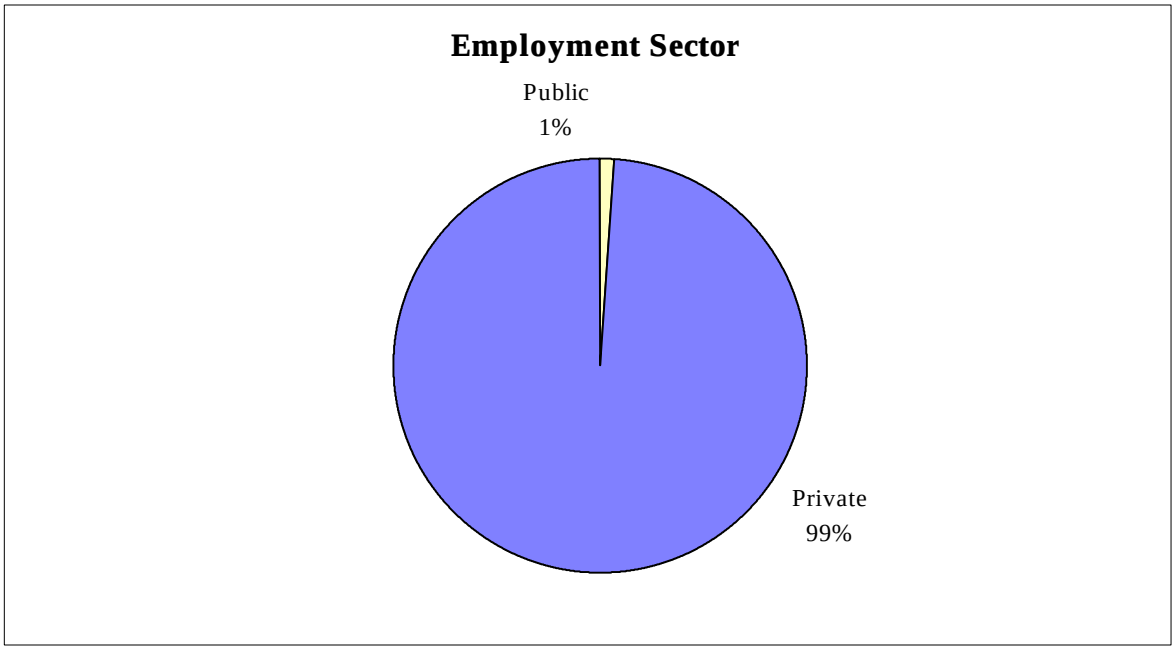

Respondents' Years of Experience as an Environmental Professional
70
60
50
40
30
20
10
0
19
47
26
7
6-10 yrs
11-15 yrs
16-20 yrs
> 21 yrs

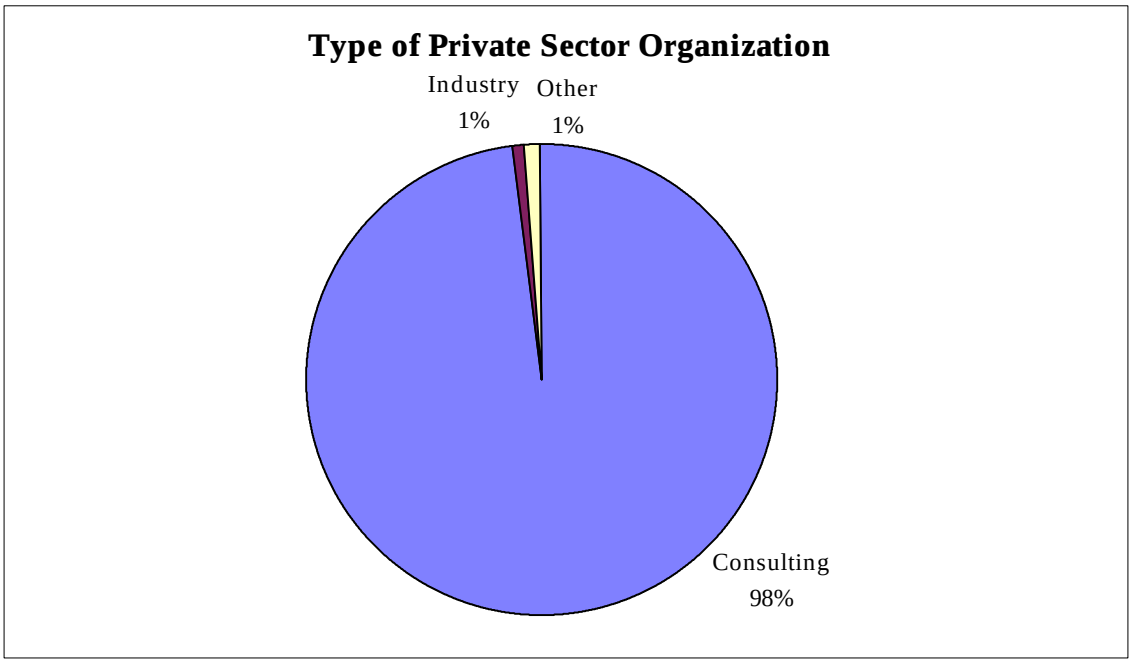

Education Level of Respondents
70
60
50
40
30
20
10
0
62
33
5
Bachelor's
Master's
Ph.D.

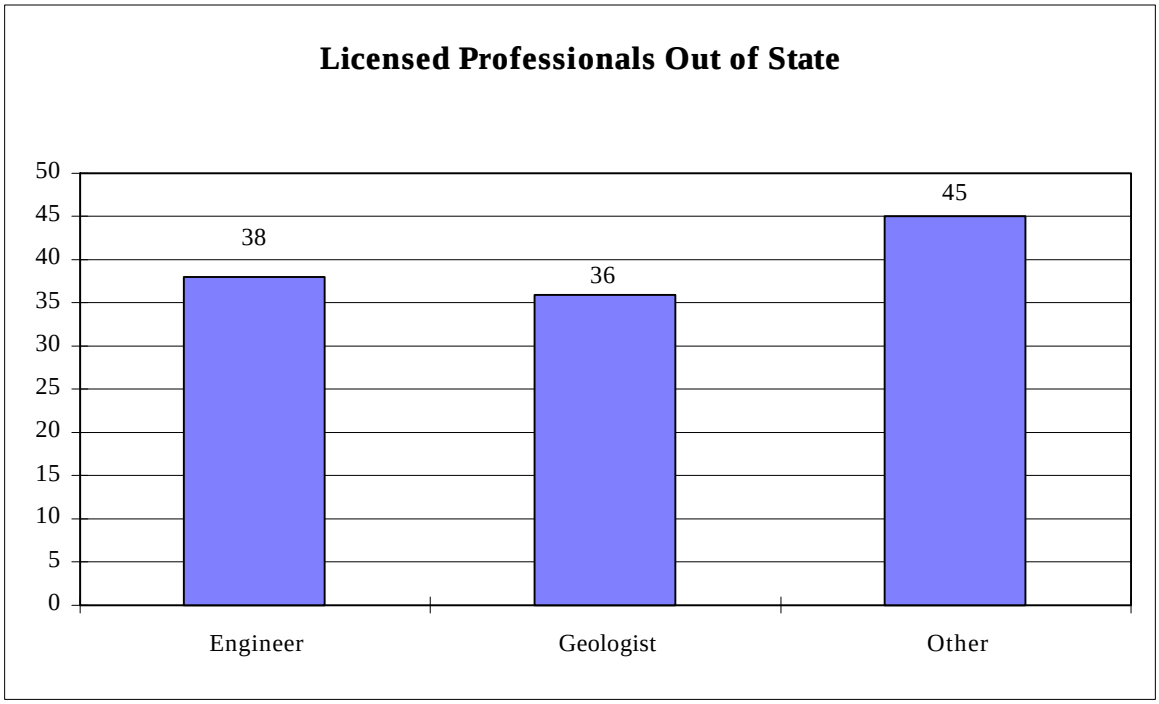

Primary Area of Expertise
40
35
30
25
20
15
10
5
0
10
12
36
14
29
3
Hydrology
Geology
Engineering
Environmental Science
Hydrogeology
Other

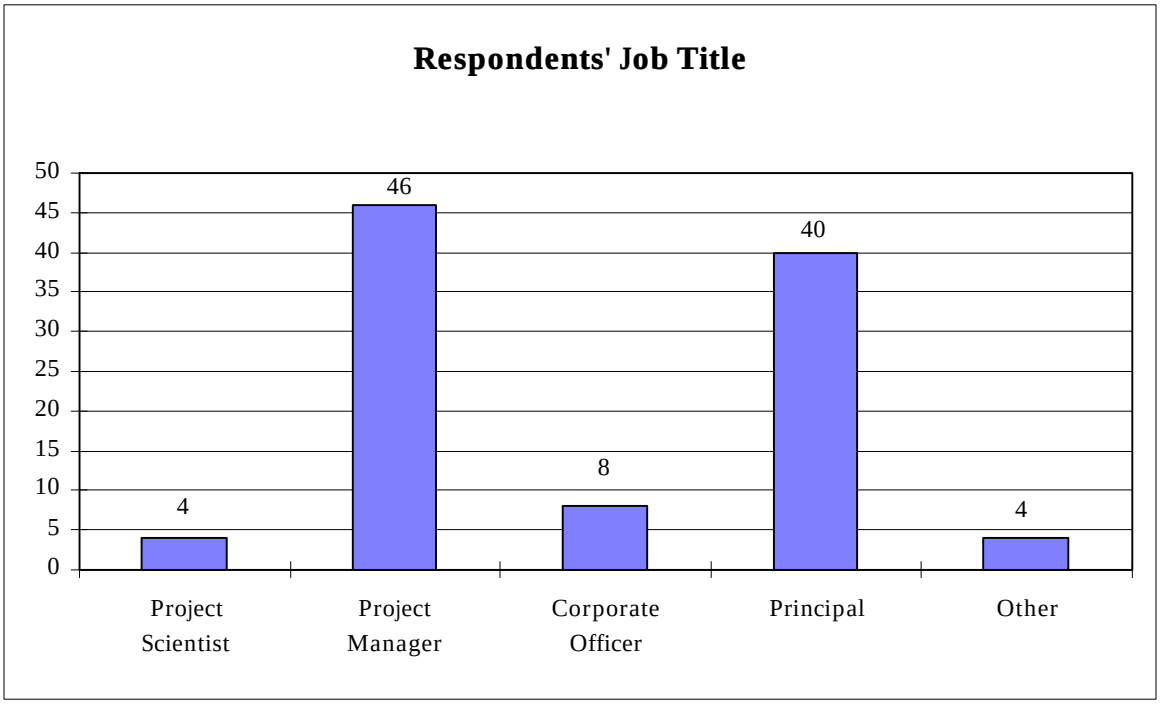

Secondary Area of Expertise
45
40
35
30
25
20
15
10
5
0
14
26
14
44
29
Hydrology
Geology
Engineering
Environmental Science
Hydrogeology


Size of Organization
30
25
20
15
10
5
0
14
19
18
22
29
< 5 employees
6-25 employees
26-100 employees
101-300 employees
> 300 employees


Employment Sector
Public
1%
Private
99%


Type of Private Sector Organization
Industry
1%
Other
1%
Consulting
98%


Licensed Professionals Out of State
50
45
40
35
30
25
20
15
10
5
0
38
36
45
Engineer
Geologist
Other


Respondents' Job Title
50
45
40
35
30
25
20
15
10
5
0
4
46
8
40
4
Project Scientist
Project Manager
Corporate Officer
Principal
Other

Evaluation of Performance Domains

Importance
Survey participants were asked to evaluate each domain and task, rating each on importance, criticality, and the frequency with which the activities associated with each domain and task are performed. Following are the evaluation scales used by the respondents.

Survey participants were asked to consider the domain and task statements carefully, listing for each the degree to which the domain or task is essential if the licensed environmental professional is to provide competent service. The scale used to evaluate domain importance is:

1. ***Not Important.*** Performance of tasks in this domain is not essential to the job performance of the environmental professional.

2. ***Somewhat Important.*** Performance of tasks in this domain is minimally essential to the job performance of the environmental professional.

3. ***Important.*** Performance of tasks in this domain is moderately essential to the job performance of the environmental professional.

4. ***Very Important.*** Performance of tasks in this domain is clearly essential to the job performance of the environmental professional.

5. ***Extremely Important.*** Performance of tasks in this domain is absolutely essential to the job performance of the environmental professional.

Criticality. The survey participants also evaluated the criticality of each domain—the degree to which inability to perform the duties associated with each domain would be seen as causing harm to the site, a client, the environmental professional, the public, etc. "Harm" may be physical, psychological, or financial, and includes exposure to legal risks due to unethical conduct. The scale for rating the criticality is included below.

1. ***No Harm.*** Inability to perform tasks in this domain would have no adverse consequences.

2. ***Minimal Harm.*** Inability to perform tasks in this domain would lead to error with minimal adverse consequences.

3. ***Moderate Harm.*** Inability to perform tasks associated with this domain would lead to error with moderate adverse consequences.

4. ***Significant Harm.*** Inability to perform tasks in this domain would lead to error with major adverse consequences.

5. ***Extreme Harm.*** Inability to perform tasks in this domain would definitely lead to error with severe adverse consequences.

Frequency. Finally, the survey participants estimated the frequency (or relevance) with which an environmental professional fulfills the duties associated with each domain. Survey respondents indicated the percentage of an average work day they spend performing duties in each domain.

The respondents used the following 5-point scale when estimating the frequency of the *tasks.*

1. ***Never.*** A licensed environmental professional never performs this task.

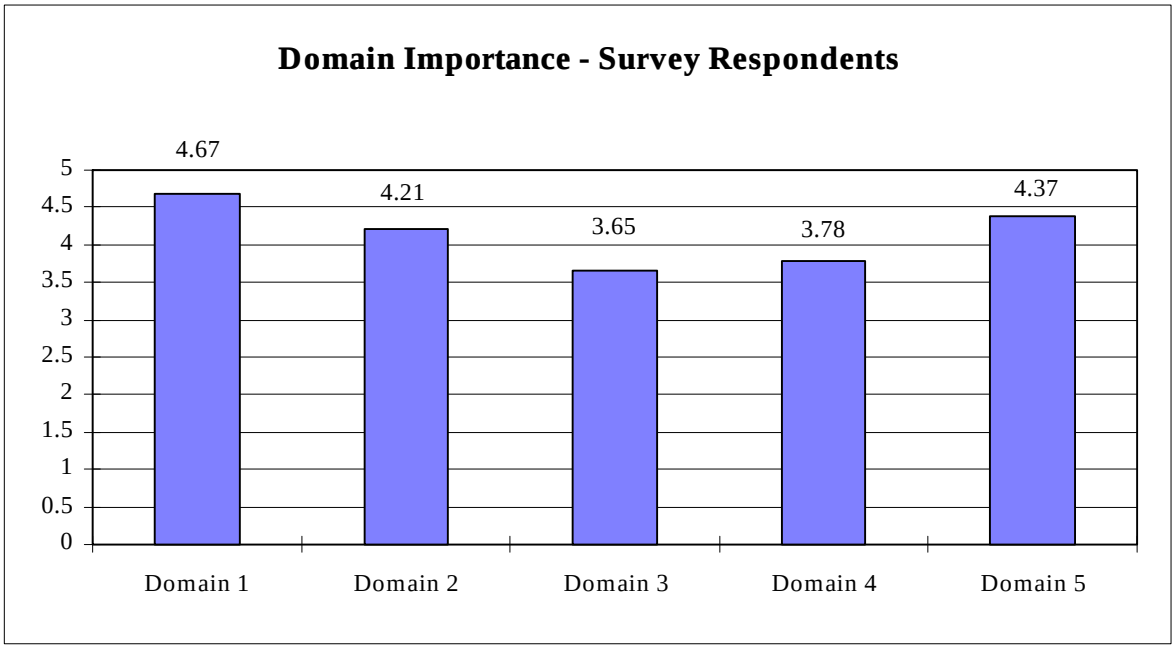
2. ***Rarely***. A licensed environmental professional rarely performs this task.

3. ***Infrequently***. A licensed environmental professional infrequently performs this task.

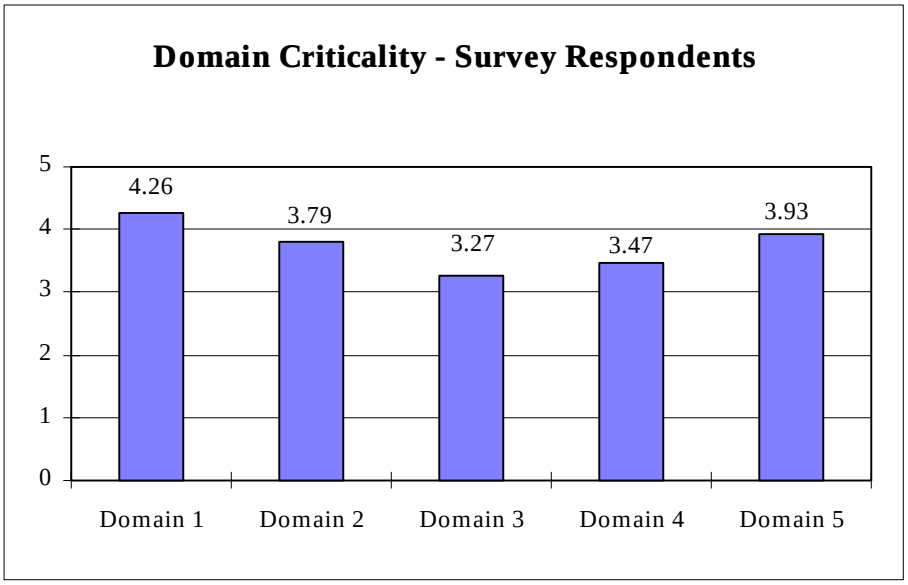
4. ***Frequently.*** A licensed environmental professional frequently performs this task.

5. ***Repetitively***. A licensed environmental professional repetitively performs this task.

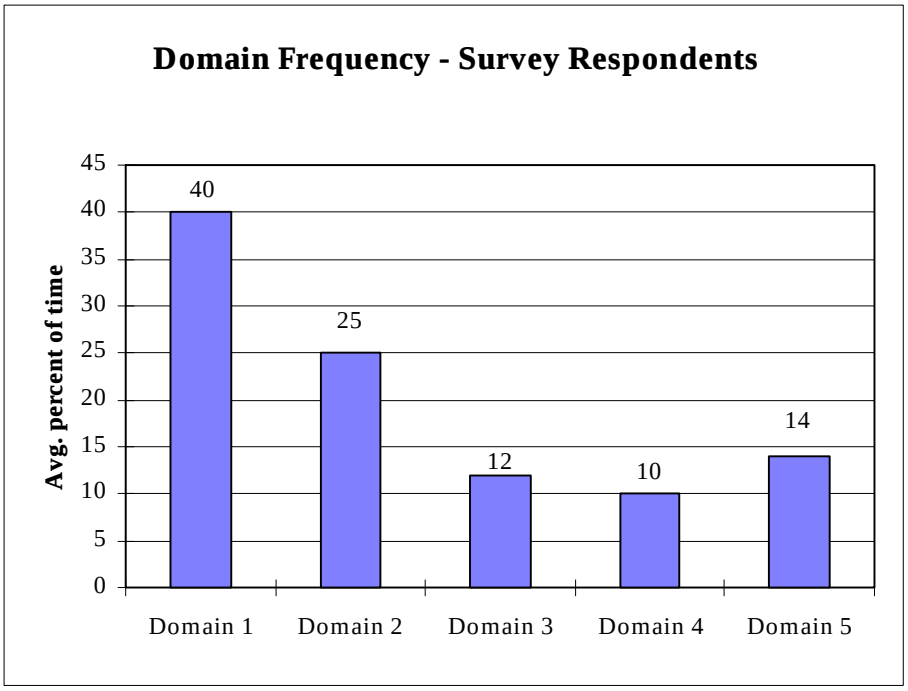
A. Survey Respondents' Evaluations. As depicted in the charts on the following pages, survey respondents rated all domains as important. Domain 1 (Site Characterization and Interpretation) is considered the most important of the domains, followed closely by Domains 5 (Professional Responsibility) and 2 (Remedy Selection and Implementation).



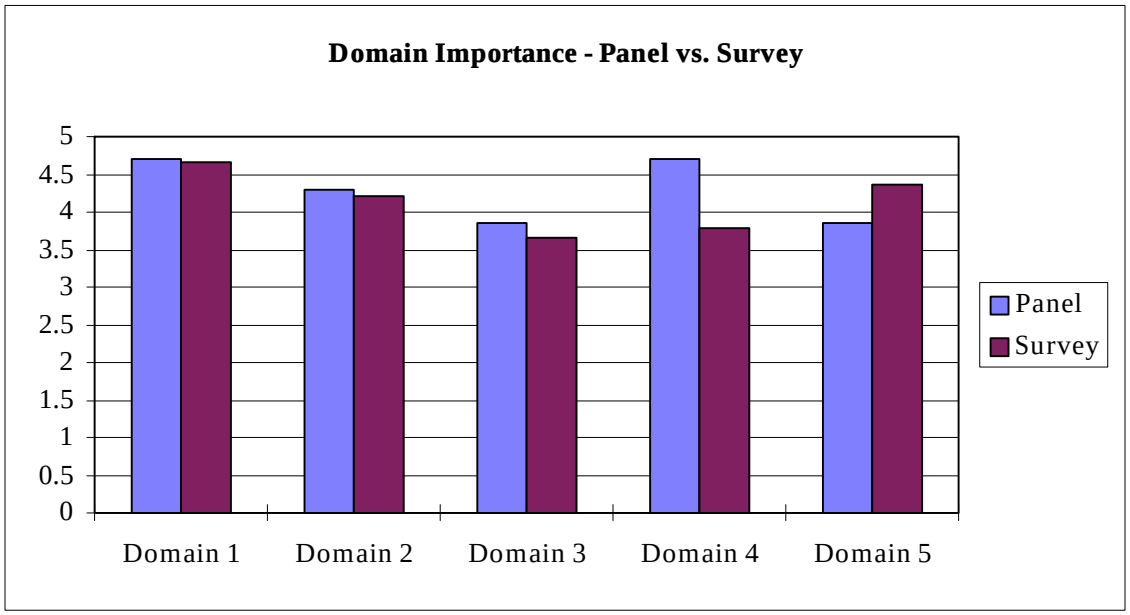
Respondents considered Domains 1 (Site Characterization and Interpretation) and 5 (Professional Responsibility) to be the most critical, or the most likely to cause harm (physical, psychological, financial, etc.) should tasks in this domain be performed incorrectly. Again, respondents found all domains to be critical and ranked them in the following order of criticality: Domain 1, Domain 5, Domain II, Domain 4 and Domain III.



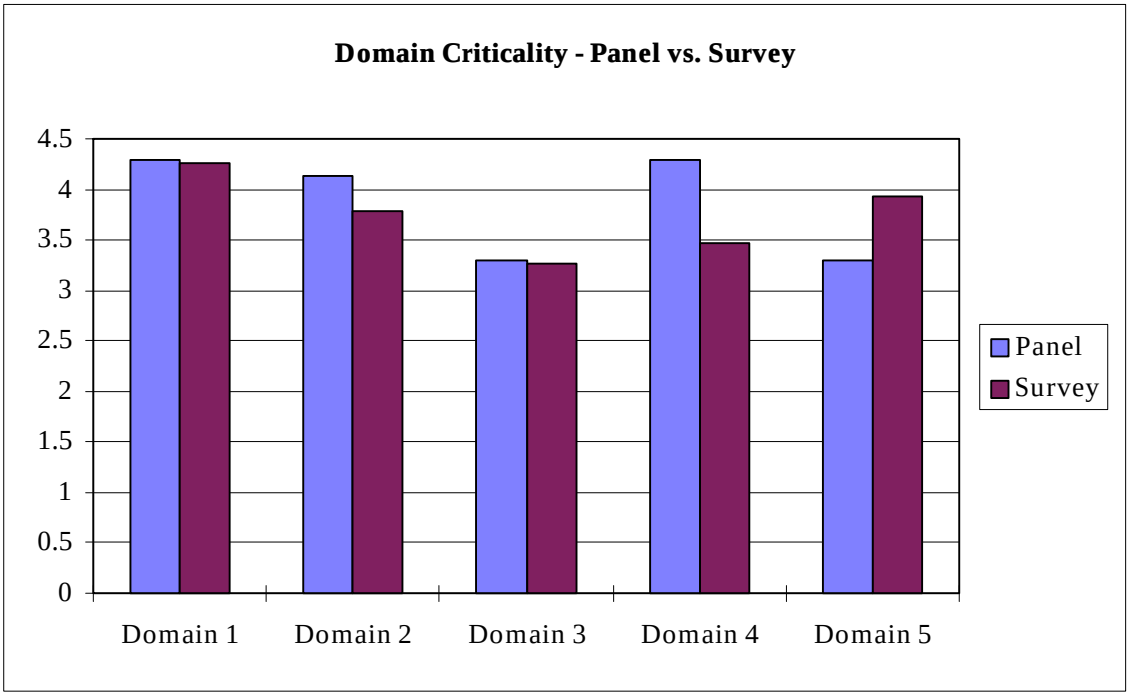
Respondents felt that most of their time is spent performing duties in Domain 1 (Site Characterization and Interpretation), followed by Domain 2 (Remedy Selection and Implementation), 5 (Professional Responsibility), 3 (Performance Evaluation), and 4 (Verification), respectively.



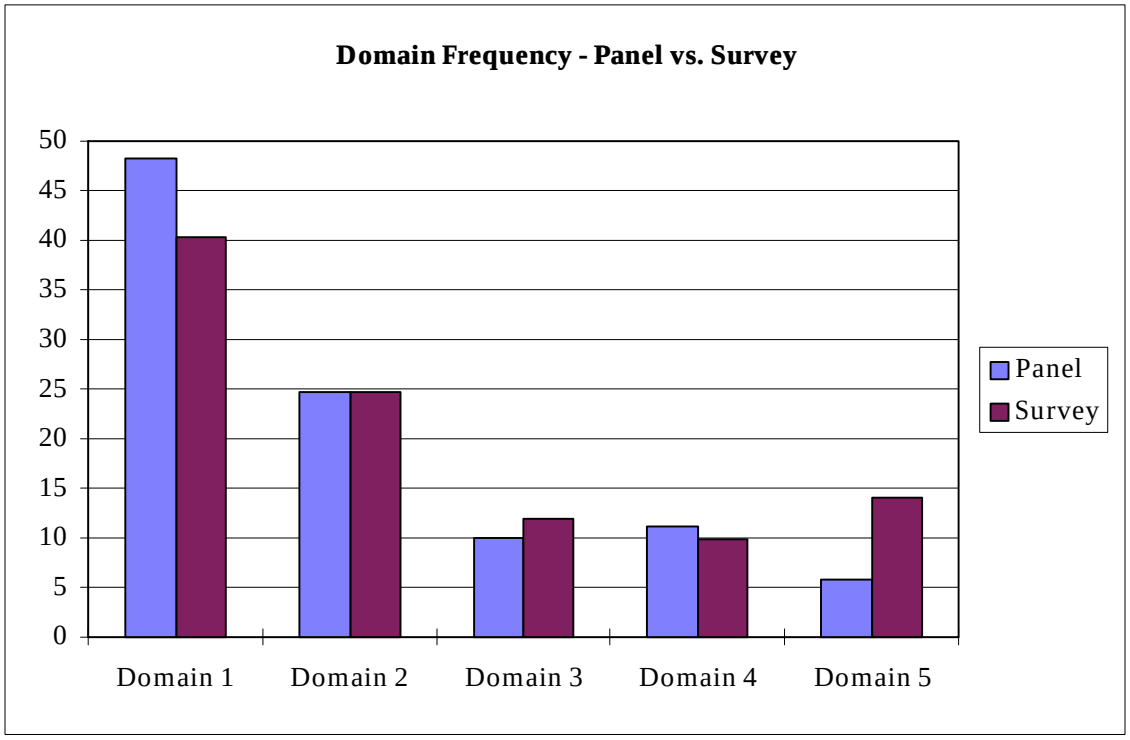
B. Panel Members' Evaluations Vs. Respondents' Evaluations. CAS collected the same data from the technical advisors as from the survey respondents as part of a preliminary validation study. The evaluations of domains by the panel members were compared to the evaluations by the survey respondents to ensure that the results were similar. As depicted in the graph below, both groups rated the importance of the domains similarly—within one rating point of each other for all domains.



As shown in the chart below, the two groups ranked the criticality of the domains similarly as well, again with the greatest variation between the groups being no more than one rating point.



As shown below, the two groups showed general similarities in their ratings of frequency. In all cases, the frequency ratings vary less than 8% between the two groups.



The similarity of panel and respondent ratings for importance, criticality, and frequency suggests that the description of work responsibility prepared by the panel accurately reflects work responsibilities as perceived by the respondents. The similarity enhances the argument that the description is valid.

C. Survey Respondent Subgroups' Evaluations. When using a survey to collect information regarding a profession, there is the possibility that individuals in various demographic settings will have differing views of the profession being delineated. A finding that the various subgroups do not all find the domains to be important, critical, or relevant would indicate that one should not generalize the survey results from one subgroup to another. With this possibility of difference in mind, CAS staff members compared the responses of specific subgroups with the responses of the overall group of respondents. The subgroups were classified by primary area of experience, secondary area of experience, place of employment, job title, LEP out of state, and size of organization.

This comparison found that the responses of the various subgroups do not vary substantially from the views of the overall group of respondents. The purpose of this comparison is to determine if each of the subgroups viewed the domains as important, critical, and relevant. While tests for the significance of between-group differences (such as analysis of variance) are available, the cell sizes, in general, are too small to permit their use. In addition, the critical issue is whether or not the subgroups view the domains as important, not which subgroups rated the domains higher than the others.

The following charts reflect the similarities in responses of the specific subgroups. Only minor variations occur between the responses. This similarity in rating of domain importance, criticality, and frequency by subgroup provides support for generalizing from the survey results to the general population of licensed environmental professionals. Subsequently, examination specifications may be developed based on this data without different content or testing methodologies for any subgroup.

Domain Importance by Years of Experience

	Domain 1	**Domain 2**	**Domain 3**	**Domain 4**	**Domain 5**
6-10	4.79	3.79	3.79	4.07	4.50
11-15	4.82	4.47	3.71	3.88	4.50
16-20	4.42	4.11	3.39	3.50	4.00
More than 21	4.60	4.00	3.80	3.60	4.60

Domain Criticality by Years of Experience

	Domain 1	**Domain 2**	**Domain 3**	**Domain 4**	**Domain 5**
6-10	4.14	3.21	3.07	3.57	4.29
11-15	4.42	4.03	3.48	3.48	4.03
16-20	4.24	3.82	3.18	3.35	3.61
More than 21	3.80	3.60	2.80	3.80	3.80

Domain Frequency by Years of Experience

	Domain 1	**Domain 2**	**Domain 3**	**Domain 4**	**Domain 5**
6-10	37.50	24.29	15.00	11.07	12.50
11-15	42.73	24.55	11.67	8.84	15.06
16-20	39.42	25.53	11.32	9.74	13.06
More than 21	43.00	22.40	9.00	12.00	9.00

Domain Importance by Educational Level

	Domain 1	**Domain 2**	**Domain 3**	**Domain 4**	**Domain 5**
Bachelor's	4.71	4.08	3.58	3.88	4.29
Master's	4.62	4.29	3.70	3.75	4.40
Ph.D.	5.00	4.00	3.50	3.50	4.50

Domain Criticality by Educational Level

	Domain 1	**Domain 2**	**Domain 3**	**Domain 4**	**Domain 5**
Bachelor's	4.17	3.88	3.33	3.50	3.79
Master's	4.26	3.79	3.28	3.51	3.95
Ph.D.	5.00	3.00	2.67	2.67	4.67

Domain Frequency by Educational Level

	Domain 1	**Domain 2**	**Domain 3**	**Domain 4**	**Domain 5**
Bachelor's	38.26	26.09	13.26	10.36	12.26
Master's	41.09	24.27	11.44	9.56	15.11
Ph.D.	45.00	21.25	11.25	8.75	11.25

Domain Importance by Primary Area of Experience

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Hydrology	4.86	4.57	3.57	3.57	4.43
Geology	4.67	3.89	3.78	4.00	4.56
Engineering	4.69	4.19	3.56	3.52	4.38
Environmental Science	4.40	3.90	3.60	3.90	4.10
Hyrdogeology	4.81	4.48	3.86	4.05	4.43
Other	3.50	3.00	2.50	3.50	4.00

Domain Criticality by Primary Area of Experience

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Hydrology	4.29	4.14	3.00	3.29	3.57
Geology	4.38	3.38	2.88	3.63	3.88
Engineering	4.28	3.80	3.20	3.40	4.04
Environmental Science	3.89	3.33	3.33	3.22	3.78
Hyrdogeology	4.29	3.86	3.57	3.71	4.14
Other	4.00	4.50	3.00	3.00	2.50

Domain Frequency by Primary Area of Experience

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Hydrology	45.00	24.29	9.29	9.67	12.43
Geology	50.56	20.00	8.89	11.11	10.00
Engineering	36.12	28.35	11.15	9.23	13.20
Environmental Science	41.00	20.50	11.00	9.50	18.00
Hyrdogeology	39.76	25.48	15.00	9.52	15.00
Other	25.00	10.00	25.00	20.00	20.00

Domain Importance by Secondary Area of Experience

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Hydrology	4.80	4.60	3.80	3.80	4.40
Geology	4.95	4.47	3.95	4.00	4.42
Engineering	4.70	4.50	4.20	4.00	4.30
Environmental Science	4.72	4.22	3.69	3.97	4.47
Hyrdogeology	4.71	4.24	3.48	3.67	4.24

Domain Criticality by Secondary Area of Experience

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Hydrology	4.40	4.30	3.50	3.70	4.20
Geology	4.21	3.89	3.53	3.63	4.00
Engineering	4.22	4.00	3.44	3.67	3.67
Environmental Science	4.19	3.94	3.32	3.52	3.94
Hydrogeology	4.53	3.84	3.05	3.26	3.89

Domain Frequency by Secondary Area of Experience

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Hydrology	39.50	28.50	11.00	9.00	21.00
Geology	37.89	26.32	14.21	9.44	17.89
Engineering	45.00	23.50	14.00	9.80	7.70
Environmental Science	38.41	25.38	11.56	11.13	12.66
Hyrdogeology	45.00	23.35	10.00	8.75	10.75

Domain Importance by Place of Employment (County)

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Fairfield	4.71	4.43	3.57	3.71	4.29
Litchfield*	5.00	4.00	4.00	3.33	4.67
Hartford	4.63	4.04	3.74	3.91	4.42
Tolland*	5.00	5.00	5.00	5.00	5.00
New London*	4.00	3.00	3.00	4.00	3.00
New Haven*	4.50	4.00	3.50	3.50	3.50
Middlesex*	4.67	4.00	4.33	4.67	4.67
Windham*	3.00	5.00	3.00	2.00	2.00
Out of State	4.75	4.28	3.50	3.69	4.44

**sample too small to be meaningful*

Domain Criticality by Place of Employment (County)

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Fairfield	4.43	4.00	3.14	3.43	4.00
Litchfield*	4.00	3.00	3.67	4.00	4.67
Hartford	4.23	4.00	3.41	3.59	4.00
Tolland*	5.00	5.00	5.00	5.00	5.00
New London*	4.00	3.00	3.00	3.00	4.00
New Haven*	4.50	4.00	3.00	2.00	3.50
Middlesex*	3.67	3.67	4.00	4.33	4.00
Windham*	3.00	4.00	2.00	2.00	1.00
Out of State	4.35	3.61	3.10	3.39	3.90

**sample too small to be meaningful*

Domain Frequency by Place of Employment (County)

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Fairfield	39.17	26.67	10.83	9.17	14.17
Litchfield*	21.67	21.67	16.67	8.33	21.67
Hartford	41.83	23.54	11.04	9.38	13.04
Tolland*	50.00	20.00	10.00	10.00	10.00
New London*	50.00	20.00	10.00	10.00	10.00
New Haven*	35.00	27.50	10.00	7.50	20.00
Middlesex*	40.00	31.67	10.00	10.00	18.33
Windham*	20.00	35.00	20.00	20.00	5.00
Out of State	40.78	25.38	12.66	10.10	13.81

**sample too small to be meaningful*

Domain Importance by Job Title

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Project Scientist	5.00	3.67	3.67	4.67	5.00
Project Manager	4.71	4.09	3.76	3.97	4.35
Corporate Officer	4.33	4.33	3.40	3.20	3.83
Principal	4.66	4.34	3.55	3.62	4.45
Other	5.00	4.33	4.00	3.67	4.33

Domain Criticality by Job Title

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Project Scientist	4.33	3.33	4.00	4.00	4.67
Project Manager	4.15	3.79	3.15	3.45	3.73
Corporate Officer	4.20	4.00	3.40	3.40	4.00
Principal	4.31	3.83	3.31	3.48	4.03
Other	5.00	4.00	4.00	3.50	5.00

Domain Frequency by Job Title

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Project Scientist	38.33	21.67	16.67	11.67	11.67
Project Manager	37.91	26.03	11.62	10.09	13.74
Corporate Officer	36.67	32.50	13.33	6.67	12.00
Principal	43.39	22.95	11.43	9.82	15.18
Other	56.67	15.00	13.33	8.33	6.67

Domain Importance by Licensed Professional Out of State

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Engineer	4.64	4.18	3.63	3.63	4.39
Geologist	4.73	4.42	3.73	3.92	4.38
Other	4.70	4.15	3.48	3.76	4.36

Domain Criticality by Licensed Professional Out of State

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Engineer	4.26	3.89	3.22	3.44	4.00
Geologist	4.12	3.72	3.32	3.48	3.88
Other	4.35	3.74	3.06	3.42	3.84

Domain Frequency by Licensed Professional Out of State

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
Engineer	37.11	28.11	10.89	9.11	12.96
Geologist	40.80	24.40	12.80	9.79	12.60
Other	40.91	23.24	13.18	11.30	13.70

Domain Importance by Size of Organization

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
< 5	4.80	4.10	3.70	3.60	4.30
6-25	4.71	4.00	3.57	3.71	4.43
26-100	4.77	4.23	3.69	4.08	4.38
101-300	4.63	4.63	3.87	3.93	4.50
>300	4.57	4.10	3.57	3.67	4.29

Domain Criticality by Size of Organization

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
< 5	4.22	3.78	3.67	3.89	4.22
6-25	4.43	3.43	3.21	3.36	3.93
26-100	4.23	4.08	3.46	3.62	4.08
101-300	4.14	3.93	3.29	3.36	4.20
>300	4.29	3.81	3.10	3.43	3.62

Domain Frequency by Size of Organization

	Domain 1	Domain 2	Domain 3	Domain 4	Domain 5
< 5	47.00	22.00	8.00	8.50	14.50
6-25	41.07	22.86	13.57	9.29	12.50
26-100	37.50	25.00	12.92	10.83	13.33
101-300	35.63	28.44	11.56	9.69	15.00
>300	42.57	23.90	12.62	10.15	14.14

Summary of Results

As shown in the data on the preceding pages, the survey respondents felt that all domains are important. Each of the five domains has an average importance of 3.65 or higher on the 5-point rating scale, with 3 being *Important* and 4 being *Very Important*. Similarly, the respondents considered all the domains to be critical. Each of the five domains has an average criticality rating of at least 3.27 on the 5-point rating scale, which means incorrect performance of the tasks in each domain could result in moderate to significant harm to a client, the environmental professional, the public, etc.

The respondents' view of the frequency of tasks performed within each domain is proportionate to the ratings assigned to the importance and criticality of the domains. For example, while respondents considered Domains 1, 5, and 2 to be the most important and critical, they also felt that they spend most of their time performing duties associated with Domain 1 (40%), Domain 2 (25%) and in Domain 5 (14%). This finding suggests that the frequency with which a licensed environmental professional performs a duty generally corresponds to that duty's importance or criticality. In other words, most duties that are performed very frequently are also considered very important or critical. This outcome affects the weight that is assigned to that domain on the examination.

Knowledge and skill statements may be classified into several groups: (a) cognitive understandings; (b) decision-making abilities; and (c) psychomotor skills.

Cognitive understandings in the environmental professional job analysis study include recall of factual information, application of information, analysis of information, and other higher order abilities. Other abilities were found in which entry-level environmental professionals process information on many topics to make and carry out decisions: *Planning, modifying, interpreting, monitoring, reacting, and revising.*

All of the knowledge statements were classified in the cognitive domain. An example of a statement that implies recall of factual information comes from Domain I: "Knowledge of Environmental regulations and permits.." An example of a knowledge statement implying a higher-order cognitive ability comes from Domain 2: "Knowledge of soil vapor extraction techniques and costs, benefits, and drawbacks."

Most skills for environmental professionals are classified as decision-making abilities. One of the skills that requires environmental professionals to make decisions by interpreting comes from Domain 2: " Understanding, interpreting, and applying RSRs and other regulations." A decision-making skill that requires the environmental professional to react comes from Domain 2: "Skill in developing corrective action plans, contingency plans, and emergency response plans. "

The psychometric analysis of knowledge and skill statements gives direction to the type of examination formats and problems for the appropriate assessment of competence in as an environmental professional.

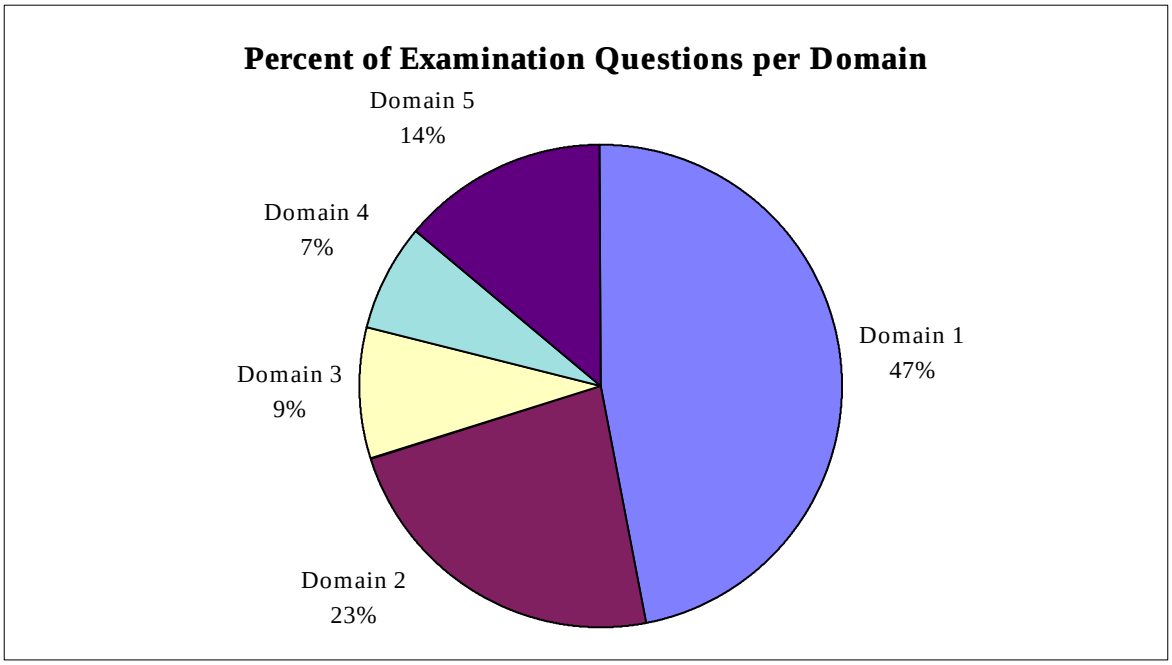
Conclusion

The data collected by the survey validates the data developed by the technical advisors. This result leads to the conclusion that the domains, tasks, knowledge, and skills constitute an accurate definition of a licensed environmental professional.

From a psychometric analysis of the tasks, knowledge, and skills developed, there is a need for one type of examination format to assess competence in environmental protection. Due to the number of abilities identified in the job analysis study which requires environmental professionals to recall, apply, and process information, a written examination is needed to assess the inherent knowledge. This examination should assess recall of factual information as well as application and analysis in roughly equal parts.

PHASE III
TEST SPECIFICATIONS

The final phase of a job analysis is the development of test specifications—a listing of the number of items from each domain and task that will appear on the multiple-choice licensure examination. Test specifications are developed by combining the overall evaluations of importance, criticality, and frequency obtained from the survey participants and converting the results into percentages. These percentages are used to determine the number of questions related to each domain and task that should appear on the multiple-choice format examination. The percent of questions that should be derived from each domain is shown below.



Domains, Tasks, and Knowledge and Skill Statements

CT-DEP Environmental professionals
Job Analysis Study

Domain 1. Site Characterization and Interpretation

Domain 2. Remedy Selection and Implementation

Domain 3. Performance Evaluation

Domain 4. Verification

Domain 5. Professional Responsibility

This section of the report contains the domains, tasks, and knowledge and skill statements as delineated by the technical advisors and survey respondents. The tasks developed by the technical advisors were compiled in a survey and presented to the respondent sample for feedback. Respondents rated the tasks according to their importance, criticality, and frequency using the five-point scales defined earlier in this report.

Performance Domain 1: Site Characterization and Interpretation

Evaluation and Allocation of Questions for Domain 1:

Task #	Importance	Criticality	Frequency	Percent of Examination Items
1	4.65	4.01	4.26	7
2	4.30	4.01	4.25	7
3	3.92	3.68	3.85	5
4	4.29	3.83	4.20	6
5	4.10	3.79	4.00	6
6	3.88	3.61	3.78	5
7	3.74	3.57	3.64	5
8	4.11	3.96	4.01	6

Total percent of questions from this domain on the examination: 47

Task Statements for Domain 1:

Tasks:

T1 Research the site's physical characteristics, environmental setting, and history by inspecting it, reviewing published and reasonably available documents and files, interviewing relevant sources / persons, etc., in order to identify substances of concern and known and potential release areas.

Knowledge of:

K1 Sources of information (content, location, and accessibility)
K2 Health and safety procedures
K3 Geology
K4 Hydrogeology
K5 Hydrology
K6 Physical and chemical properties of substances of concern
K7 Substances used in residential, industrial, commercial, or agricultural practices and methods of storage, use, and disposal
K8 Industrial, commercial, or agricultural processes
K9 Site features and activities (drainage features, traffic patterns, building construction, general business practice, infrastructure, etc.)
K10 Environmental regulations and permits
K11 Local laws, regulations, and ordinances

Skill in:

S1 Recognizing relevant site and area features, activities, and environmental receptors.
S2 Locating, evaluating, and consolidating research materials.
S3 Conducting thorough and relevant interviews.
S4 Reading, understanding and interpreting maps and aerial photographs.
S5 Making good photographic records.
S6 Applying logic to presence of substances of concern and potential pathways.
S7 Writing and communicating.
S8 Making good field notes.

T2 Determine if additional investigation is necessary by assessing substances of concern and potential release areas in order to evaluate the likelihood of site contamination.

Knowledge of:

K1 Substances of concern.
K2 Processes of concern.
K3 Pathways of concern
K4 Potential release mechanisms.
K5 Potentially impacted media and receptors.

Skill in:

S1 Identifying chemicals typical to subject site use.
S2 Observing critical site features.
S3 Formulating conceptual understanding of pathways of concern.
S4 Assessing visual clues for significance / pathway exposure.
S5 Identifying logical source / pathway connections.

T3 Develop a conceptual model of migration pathways for substances of concern stemming from potential release areas by identifying fate and transport characteristics in order to design a Phase II site investigation.

Knowledge of:

K1 Physical and chemical properties of substances of concern and their behavior in the environment.
K2 Soil, sediment characteristics, physical and chemical sorptive capacity, permeability, etc.
K3 Biological influences on substances in the environment.
K4 Geology.
K5 Hydrogeology.
K6 Potential release mechanisms.
K7 Pathways of concern.
K8 Potentially affected media.
K9 Regional meteorology (precipitation, water budget, wind patterns).
K10 Hydrology and sediment transport (related to surface drainage).
K11 3-D spatial relationships

Skill in:

S1 Estimating groundwater flow characteristics.
S2 Understanding degradation and attenuation of contaminants.
S3 Identifying receptors.
S4 Identifying potential contaminant pathways and transport mechanisms.
S5 Integrating the components of conceptual site models.
S6 Visualizing spatial relationships.f.
S7 Understanding temporal relationships.

T4 Design a Phase II investigation for sampling environmental media most likely to be contaminated by considering the conceptual model and selecting appropriate investigative techniques in order to determine if substances of concern are present.

Knowledge of:

K1 The conceptual site model.
K2 Subsurface investigative techniques.
K3 Well design and construction methods.
K4 Sampling techniques and procedures.
K5 Geophysical investigation techniques.
K6 Laboratory testing methods.
K7 Sample screening techniques.
K8 Quality Assurance / Quality Control practices.
K9 Health and safety procedures.
K10 Environmental regulations and permits.
K11 Local laws, regulations, and ordinances.
K12 Physical site constraints to investigative techniques.
K13 Scheduling requirements.
K14 Remote sensing techniques.
K15 Cost of investigation activities.

Skill in:

S1 Designing sampling plans.
S2 Applying regulatory requirements.
S3 Locating underground utilities.
S4 Developing health and safety plans.
S5 Writing technical documents.
S6 Creating maps and graphics.
S7 Estimating cost.

T5 Conduct the Phase II investigation by collecting and analyzing data in order to validate or refine the conceptual model and provide an opinion regarding the presence of substances of concern.

Knowledge of:

K1 Subsurface investigation techniques.
K2 Monitoring well installation techniques.
K3 Environmental media sampling techniques.
K4 Conceptual Site Model.
K5 Site health and safety procedures.
K6 Fate and transport characteristics of contaminants of concern.
K7 Geology, hydrology, hydrogeology, and soil morphology field procedures.
K8 Physical and chemical properties of the substances of concern.
K9 Analytical chemistry methods and detection limits.
K10 Quality Assurance and Quality Control.
K11 Phase II plan.
K12 Survey techniques.

Skill in:

S1 Constructing a monitoring well.
S2 Sampling environmental media.
S3 Monitoring and recognizing site hazards and risks.
S4 Using personal protective equipment.
S5 Measuring groundwater levels.
S6 Maintaining sample chain of custody.
S7 Identifying potential areas of contamination.
S8 Calculating rate and direction of groundwater flow.
S9 Estimating natural attenuation of substances of concern.
S10 Classifying soil and rock types.
S11 Conducting geophysical surveys.
S12 Performing remote sensing and/or interpretation.
S13 Writing technical documents.
S14 Integrating facts to validate or expand and refine the site model.
S15 Recognizing background concentrations of naturally occuring substances of concern.
S16 Managing contractors.
S17 Personal interaction.
S18 Interpreting data.

T6 Design Phase III investigations by considering the conceptual model and identifying data gaps in order to define the nature and extent of contamination and understand fate and transport of substances of concern.

Knowledge of:

K1 The conceptual site model.
K2 Subsurface investigative techniques.
K3 Well design and construction methods.
K4 Sampling techniques and procedures.
K5 Geophysical investigation techniques.
K6 Laboratory testing methods.
K7 Sample screening techniques.
K8 Quality Assurance/Quality Control practices.
K9 Health and safety procedures.
K10 Environmental regulations and permits.
K11 Local laws, regulations, and ordinances.
K12 Physical site constraints to investigative techniques.
K13 Scheduling requirements.
K14 Remote sensing techniques.
K15 Cost of investigation activities.
K16 Risk assessment principles and data requirements.
K17 Strategies for identifying data gaps to satisfy the requirements of the Remediation Standards Regulations (RSR).
K18 Statistical methods.

Skill in:

S1. Applying statistical methods.
S2. Understanding spatial relationships in the subsurface.
S3. Distinguishing between the presence of contamination and the presence of naturally occurring substances of concern
S4. Applying RSR criteria to Phase III data on the nature and extent of substances of concern
S5. Designing sampling plans.
S6. Applying regulatory requirements.
S7. Locating underground utilities.
S8. Developing health and safety plans.
S9. Writing technical documents.
S10. Creating maps and graphics.
S11. Estimating cost.
S12. Identifying and filling data gaps.

T7 Conduct Phase III investigations by collecting and analyzing data in order to validate or further refine the conceptual model and provide an assessment regarding the extent and degree of substances of concern.

Knowledge of:

K1 Conceptual Site Model.
K2 Subsurface investigation techniques.
K3 Monitoring well installation techniques.
K4 Environmental media sampling techniques.
K5 Site health and safety procedures.
K6 Fate and transport characteristics of contaminants of concern.
K7 Geology, hydrology, hydrogeology, and soil morphology field procedures.
K8 Physical and chemical properties of the substances of concern.
K9 Analytical chemistry methods and detection limits.
K10 Quality Assurance and Quality Control.
K11 Phase III plan.
K12 Survey techniques.

Skill in:

S1 Constructing a monitoring well.
S2 Sampling environmental media.
S3 Monitoring and recognizing site hazards and risks.
S4 Using personal protective equipment.
S5 Measuring groundwater levels.
S6 Maintaining sample chain of custody.
S7 Identifying the degree and extent of contamination.
S8 Calculating rate and direction of groundwater flow.
S9 Estimating natural attenuation of substances of concern.
S10 Classifying soil and rock types.
S11 Conducting geophysical surveys.
S12 Performing remote sensing and/or interpretation.
S13 Writing technical documents.
S14 Integrating facts to validate or expand and refine the site model.
S15 Managing contractors.
S16 Personal interaction.
S17 Interpreting data.
S18 Determining that site characterization is complete or that data gaps remain.

T8 Compare the results of the Phase III investigations to RSRs using the criteria set forth to determine compliance or the need for remedial actions.

Knowledge of:

K1 Results of site characterization.
K2 RSRs, including exceptions, variances, and alternative evaluations.
K3 Other environmental regulations and permits.
K4 Fate and transport. *(use earlier language)*
K5 Groundwater classification.
K6 Current and future land use.

Skill in:

S1 Understanding, interpreting, and applying RSRs and other regulations.
S2 Understanding, interpreting, and applying mathematics and statistics.
S3 Developing 7Q10 and watershed domains.
S4 Securing cooperation from involved or concerned individuals or entities.
S5 Calculating groundwater flow direction, seepage rate, and seasonal fluctuation of the water table (applying sound hydrogeologic practices).
S6 Understanding analytical techniques and detection levels.
S7 Applying chemical principles to substances of concern.
S8 Estimating costs; evaluating social benefits versus environmental benefits.
S9 Applying sound engineering practices.
S10 Understanding and applying the risk assessment process.
S11 Applying decision criteria and logic to evaluation of alternatives.
S12 Communicating requests for variances to the Commissioner and the public.

Performance Domain 2: Remedy Selection and Implementation

Evaluation and Allocation of Questions for Domain 2:

Task #	Importance	Criticality	Frequency	Percent of Examination Items
1	4.08	3.69	3.92	5
2	3.56	3.21	3.41	3
3	3.51	3.17	3.33	3
4	2.96	2.82	2.93	2
5	3.52	3.24	3.23	3
6	3.71	3.25	3.64	3
7	3.78	3.44	3.80	4

Total percent of questions from this domain on the examination: 23

Task Statements for Domain 2:

Tasks:

T1 Identify remedial action goals by applying the RSR and other regulations and by recognizing the site's physical characteristics, the schedule for achieving the goals, and current and future land use considerations in order to select remedial strategies.

Knowledge of:

K1 RSR content and allowable alternatives and variances and methodologies to develop site-specific alternatives.
K2 Other applicable regulation content (air, water, waste, discharge, etc.).
K3 Physical conditions affecting fate and transport.
K4 Physical conditions affecting remedies.
K5 Geologic materials and properties.
K6 Groundwater flow behavior.
K7 Chemical behavior in the environment (degradation, attenuation, dispersion).
K8 Attributes (benefits and drawbacks) of remedial techniques.
K9 Client desires for timing of remediation.
K10 Current site use.
K11 Future site use.
K12 Toxicological risk posed by substances of concern.
K13 Immediacy of risk.

Skill in:

S1 Applying RSRs.
S2 Applying regulatory requirements.
S3 Identifying regulatory constraints.
S4 Recognizing physical conditions which affect remediation.
S5 Recognizing geologic factors which affect remediation.
S6 Recognizing critical hydrogeologic factors affecting remediation.
S7 Understanding chemical behavior under site conditions.
S8 Identifying reasonably obtainable outcomes.
S9 Performing human health risk assessments.

T2 Screen potential remedial strategies by reviewing technologies and alternative criteria, variances, and exceptions requiring Commissioner approval in order to identify the most promising remedial strategies.

Knowledge of:

K1 Applicability of RSR alternative criteria and variances and exceptions.
K2 Risk assessment techniques.
K3 Contaminant chemistry, toxicity, and solubility.
K4 Waste soil, water, and air handling or treatment technologies.
K5 Soil vapor extraction techniques and costs, benefits and drawbacks.
K6 Groundwater flow control techniques and costs (wells, trenches, slurry walls), benefits and drawbacks.
K7 Bioremediation principles, techniques, costs, benefits, and drawbacks.
K8 Approximate costs of mechanical / electrical equipment commonly used for water, soil, and soil vapor extraction, handling and treatment.
K9 Hazardous waste characterization and handling practices.
K10 Environmental permit requirements and regulations applicable to air and water emissions.
K11 Local land use regulations.
K12 General construction technologies, materials, and costs.
K13 Waste stabilization techniques, benefits, drawbacks, and costs.
K14 General waste / contaminant containment techniques, benefits, drawbacks, and costs.

Skill in:

S1 Researching and computing alternate standards and determining toxicity levels.
S2 Applying regulatory standards.
S3 Determining contaminant characteristics.
S4 Identifying relevant soil characteristics.
S5 Identifying relevant groundwater flow and chemistry.
S6 “Designing” conceptual groundwater flow control systems.
S7 “Designing” conceptual soil vapor control systems.
S8 Designing conceptual coil management plans.
S9 “Designing” conceptual contaminant extraction facilities.
S10 Interpreting land use regulations.
S11 Interpreting environmental regualtions (air and water discharge and waste management).
S12 Conducting risk assessments.
S13 Estimating construction operation and management costs.
S14 Identifying maintenance and management issues and problems.
S15 Communicating research data to clients and regulators.
S16 Documenting critical decision making criteria.

T3 Evaluate the feasibility of each promising remedial strategy by considering selection criteria such as the capability of the technology, the time required to achieve the goal, public acceptance, and cost in order to prioritize remedies and identify data needs for final selection.

Knowledge of:

K1 Remediation technologies.
K2 Risk reduction methods.
K3 Cost estimating information sources.
K4 Contaminant fate and transport.
K5 Geology.
K6 Hydrogeology.
K7 Exposure pathways and receptors.
K8 Chemistry and biochemistry.
K9 Regulatory requirements (CWA, CAA, TSC, RCRA, RSR, wetlands, etc.).
K10 Toxicology.
K11 Hydraulics.
K12 Hydrology.
K13 Modeling.

Skill in:

S1 Preliminary sizing and conceptual layout of remedial systems.
S2 Cost estimating.
S3 Estimating performance of remedial technologies.
S4 Applying regulatory requirements (permitting).
S5 Performing risk assessment.
S6 Statistics and geostatistics.
S7 Mass balance calculations.

T4 Fill data needs by conducting bench-scale or pilot-scale tests, modeling, supplemental field sampling, etc., in order to allow selection of the final remedy.

Knowledge of:

K1 Available remediation technologies and their basic chemical and physical processes.
K2 Soil and groundwater chemistry.
K3 RSRs.
K4 Hydrogeologic and geochemical modeling.
K5 Field hydrogeologic methods.

Skill in:

S1 Performing pump tests and interpreting data.
S2 Performing soil permeability tests and interpreting data.
S3 Developing a site hydrogeologic model.
S4 Determining physical/chemical properties of soil.
S5 Conducting chemical treatability tests.

T5 Select the final remedy by reapplying selection criteria in light of newly acquired data in order to provide the basis for design and/or implementation.

Knowledge of:

K1 How remedial equipment operates and what it can achieve.
K2 Limitations of remedial processes.
K3 Costs of remedial options.
K4 Elements of feasibility evaluations.

Skill in:
S1 Cost estimating.
S2 Ranking technological options.

T6 Collaborate with qualified professionals by communicating remediation objectives in order to achieve the final design and specifications for the remedy.

Knowledge of:
K1 Limitations of remediation systems and techniques.
K2 Costs associated with remedies.
K3 Rate at which remediation must occur.
K4 Site limitations to accommodate the remedy.

Skill in:
S1 Determining remedy limitations.
S2 Applying site physical parameters to the remedy.
S3 Calculating costs of remedies.

T7 Monitor the remedy's implementation in collaboration with other qualified professionals, as necessary, by conducting field observations and testing, etc., in order to confirm consistency with design objectives and remedial goals.

Knowledge of:
K1 Design objectives and goals.
K2 Personal limitations.
K3 Knowledge level and competence of potentially collaborative professionals.
K4 Appropriate testing techniques.
K5 Remedial activity or technology.
K6 Expected or desired duration of remedial activity.

Skill in:
S1 Developing and implementing sampling plans.
S2 Developing and implementing inspection plans.
S3 Understanding remedial goals.
S4 Understanding design objectives.
S5 Understanding remedial process and limitations.
S6 Communicating with other professionals, clients, contractors, and members of the public.
S7 Recognizing health and safety issues.
S8 Recognizing potential adverse environmental effects of remedy implementation.
S9 Documenting findings and observations.
S10 Developing corrective action plans, contingency plans, and emergency response plans.

Performance Domain 3. Performance Evaluation

Evaluation and Allocation of Questions for Domain 3:

Task #	Importance	Criticality	Frequency	Percent of Examination Items
1	3.79	3.30	3.73	3
2	3.75	3.23	3.78	3
3	3.70	3.26	3.49	3

Total percent of questions from this domain on the examination: 9

Task Statements for Domain 3:

Tasks:

T1 Monitor performance of the remedy by making appropriate measurements and observations to determine if it is functioning as intended.

Knowledge of:
- K1 Remedial technique(s) in operation at the site.
- K2 Physical system components and operation.
- K3 Intended and desired operational parameters.
- K4 Types of measurement and observation appropriate to system (operational and regulatory).
- K5 How to obtain each measurement.
- K6 How to apply each measurement to actual system (what it means).

Skill in:
- S1 Observing all critical parameters.
- S2 Applying measurement techniques (using PID, FID, GC, pressure gauge, flow meter, etc.).
- S3 Understanding allowable system tolerances.
- S4 Understanding how the measurements and observations related to system performance.
- S5 Deciding if a measurement or observation indicates a problem with the system.
- S6 Communicating results, opinions, and rationales.
- S7 Documenting observations and, measurements for the record.

T2 Monitor environmental media by sampling and testing to evaluate if the remedy is progressing toward the achievement of remedial goals.

Knowledge of:
- K1 Methods for sampling environmental media (including quality assurance measures).
- K2 Assessment of trends and variability in environmental data.
- K3 How operating remedial systems affect subsurface conditions (e.g., groundwater flow directions, groundwater and soil vapor contaminant levels).

Skill in:

S1 Applying basic statistics to environmental data populations.
S2 Sampling environmental media.
S3 Quality assurance checking of laboratory data.

T3 Modify the remedy as necessary by responding to changed conditions indicated by monitoring data and/or revised remedial goals in order to enhance performance.

Knowledge of:

K1 Statistical methods in data analysis.
K2 Current regulatory standards.
K3 Current emerging remediation technologies.

Skill in:

S1 Plotting trends in monitoring data.
S2 Identifying changes in regulations.
S3 Identifying the most pertinent information on new technologies.

Performance Domain 4. Verification

Evaluation and Allocation of Questions for Domain 4:

Task #	Importance	Criticality	Frequency	Percent of Examination Items
1	3.85	3.61	3.99	1
2	4.07	3.77	4.00	3
3	4.27	3.85	3.75	3

Total percent of questions from this domain on the examination: 7

Task Statements for Domain 4:

Tasks:

T1 Evaluate whether or not investigations have been performed in accordance with prevailing standards and guidelines by reviewing all existing data in order to make an appropriate verification decision.

Knowledge of:
K1 All previous investigations.
K2 Prevailing standards and guidelines
K3 RSR requirements.
K4 QA techniques.

Skill in:
S1 Performing thorough and critical reviews of the data.
S2 Applying Quality Assurance techniques.
S3 Writing technical documents.

T2 Evaluate whether or not the site has been remediated in accordance with RSRs by reviewing all existing data in order to make an appropriate verification decision.

Knowledge of:
K1 Applicable RSR requirements.
K2 QA techniques.
K3 Basic statistical methods for evaluating environmental data populations.
K4 All available data documenting current site conditions and performance monitoring.

Skill in:

S1 Identifying elements of the RSR applicable to the site.
S2 Understanding 3-D spatial relationships in the subsurface.
S3 Identifying appropriate chemical testing methodologies for the substances of concern and media being tested, and quality assurance checking of laboratory data.
S4 Identifying appropriate sampling methodologies for the affected environmental media and the substances of concern that were contained therein.
S5 Data base management and manipulation.
S6 Applying statistics to environmental data.
S7 Comparing the project's remedial action goals with the RSRs.

T3 Verify that investigations have been performed in accordance with prevailing standards and guidelines and that the site has been remediated in accordance with the RSRs by rendering an opinion that no further action is necessary.

Knowledge of:

K1 RSR default criteria.
K2 Confirmation sampling data requirements.
K3 Site Remediation objectives.

Skill in:

S1 Applying remediation standards to confirmation sample results.
S2 Completing monitoring program.
S3 Confirming contaminant concentrations upon termination of remediation.
S4 Determining impracticability of remediation techniques.

Performance Domain 5. Professional Responsibility

Evaluation and Allocation of Questions for Domain 5:

Task #	Importance	Criticality	Frequency	Percent of Examination Items
1	3.74	2.89	3.86	2
2	4.64	4.10	4.62	5
3	3.63	3.01	4.13	3
4	4.25	3.52	4.51	4

Total percent of questions from this domain on the examination: 14

Task Statements for Domain 5:

Tasks:

T1 Pursue professional development by attending professional seminars, reading technical journals, etc., in order to maintain continuing competence.

Knowledge of:
- K1 Relevant technical journals.
- K2 Relevant professional seminars.
- K3 Relevant technical and professional courses.
- K4 The Internet.

Skill in:
- S1 Reading and comprehending technical material.
- S2 Comprehending technical material presented orally.
- S3 Using the Internet.

T2 Adhere to the Rules of Professional Conduct for LEPs as embodied in the regulations by acting with integrity at all times in order to hold paramount human health and the environment.

Knowledge of:
- K1 Rules of Professional Conduct for LEPs.
- K2 Contract provisions for standard of care, confidentiality, fee setting, conflict of interest, and vested interest.
- K3 Circumstances which may lead to misconduct.

Skill in:
- S1 Identifying appropriate contract provisions to protect against pressures to engage in misconduct.
- S2 Negotiating and defending appropriate contract provisions.

T3 Perform only those activities necessary to support site characterization, remediation, and verification by adhering to prevailing standards of care in order to avoid excessive or duplicative activities.

Knowledge of:

K1 Boundaries of reasonableness in practice.
K2 Necessary and sufficient activities for site characterization, remediation, and verification.
K3 Prevailing standards of care.
K4 Previous investigations of the site.

Skill in:

S1 Using previous analyses of the site.
S2 Performing critical and thorough reviews of existing data.

T4 Construct a project record by documenting factual information sufficient to support the actions taken and decisions made and to communicate findings to clients and regulatory bodies.

Knowledge of:

K1 Boundaries of reasonableness in practice.
K2 Necessary and sufficient activities for site characterization, remediation, and verification.
K3 Prevailing standards of care.
K4 Previous investigations of the site.

Skill in:

S1 Using previous analyses of the site.
S2 Performing critical and thorough reviews of existing data.

Appendix I

CT-DEP Technical Advisor Panel

Kathy Cyr
GZA GeoEnvironmental, Inc.

Fred Johnson
United Technologies Corporation

Bob Lamonica
Leggette, Brashears & Graham, Inc.

Bob Leach
HRP Associates

Jeff Loureiro
Loureiro Engineering Associates

Thomas RisCassi
Department of Environmental Protection

Dennis Waslenchuk
ALTA Environmental Corporation

James P. Henderson, Ph.D.
Columbia Assessment Services
3725 National Drive
Raleigh, NC 27612
919-787-2721
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Appendix II

Contents of Job Analysis Survey

This booklet contains the State of Connecticut, Department of Environmental Protection (CT DEP) Licensed Environmental Professional (LEP) Role Delineation Survey, along with instructional materials to aid you in completing it. Directions are provided at the beginning of each section of the survey.

In **Section A,** you are asked to complete a ***Confidential Survey*** which provides us with the demographic information necessary to ensure that professionals working in various settings with differing backgrounds are represented in the data collection.

In **Section B,** we have provided you with a list of definitions and terms that are used throughout the survey. We suggest that you review the ***Definition of Terms*** before responding to any survey questions.

In **Section C,** you are asked to review the ***Performance Domains*** which define the decision-making skills necessary to perform the duties of an environmental professional. We ask that you rate the importance, criticality, and frequency of these domains.

In **Section D,** you are asked to review the ***Task Statements*** required for competent performance in each domain, and then rate each for importance, criticality and frequency.

Please review the entire booklet before responding to any of the questions. Your review will help you to understand our terminology and the structure of the Role Delineation Survey.

Please mark your responses directly in this booklet. After completing all sections of the survey, please return the entire booklet by **December 27, 1996,** in the enclosed, stamped envelope to:

Columbia Assessment Services, Inc.

3725 National Drive, Suite 213

Raleigh, North Carolina 27612.

Please fill in the following demographic information, which will be used to ensure that professionals working in various settings with differing backgrounds are represented in the data collection.

All answers and numbers are kept strictly confidential by Columbia Assessment Services, Inc. Computer programs are used to sort the data. No individual person or firm, or the particular data of each, will be identifiable in any report generated using information obtained through this survey. If there is information you do not wish to provide, please leave that survey item blank.

Please print.

Name: _____ Age _____

Male _____ Female _____

Telephone Number (in case we have questions about your responses) _____

Ethnic Background:

____ African American ____ Hispanic American / Latino

____ Asian American ____ Native American / Indian

____ Caucasian ____ Other (please specify) _____

Number of years as an environmental professional:

____ Less than 1 ____ 11 - 15 years

____ 1 - 5 years ____ 16 - 20 years

____ 6 - 10 years ____ 21+ years

In which county is your place of employment?

____ Fairfield ____ New Haven

____ Litchfield ____ Middlesex

____ Hartford ____ Windham

____ Tolland ____ Out of state

____ New London

In which sector are you employed?

____ public ____ private

If employed in the private sector, how would you describe the organization?

____ consulting ____ financial institution

____ industry ____ other _____

How many individuals are employed in the organization in which you work?

____ fewer than 5 ____ 100-300

____ 6-25 ____ more than 300

____ 26-100

Which category best describes your job title?

____ Project scientist ____ Corporate officer

____ Project manager ____ Principal / Associate

____ Regulator ____ Other

What percent of the average work day do you spend performing duties related to the investigation and / or remediation of soil and groundwater contamination?
_____%

How many years of experience do you have in the investigation and / or remediation of soil and groundwater contamination?

_____ years

Are you licensed as any of the following in any state?

____ engineer ____ geologist _____ other (please specify)_____

What is the highest level of education that you have achieved?

____ High school diploma certification or equivalent

____ Associate's degree

____ Bachelor's degree

____ Master's degree

____ Doctoral degree

What is your **PRIMARY** area of expertise? (please choose only one.)

____ hydrology

____ geology

____ engineering

____ environmental science

____ hydrogeology

____ natural resource management

____ soil sciences

____ water resources

____ other

What is (are) your **SECONDARY** area(s) of expertise?

____ hydrology

____ geology

____ engineering

____ environmental science

____ hydrogeology

____ natural resource management

____ soil sciences

____ water resources

____ other

Section B
Definition of Terms Used in the Role Delineation Survey

Below are definitions of some of the terms found in the Role Delineation Survey:

Licensed Environmental Professional: The Licensed Environmental Professional (LEP) possesses a bachelor's degree or higher in a relevant field, eight years of experience in investigation and remediation, including four of responsible charge, passing status on the examination, and good moral character. Without a formal degree, LEPs have 14 years of experience, including seven of responsible charge, in addition to passing status on the examination and good moral character. LEPs are qualified to verify that sites are remediated in accordance with Remediation Standard Regulations.

Performance Domain: The major tasks or duties that define the role of the licensed environmental professional. Each performance domain may be considered a major heading in an outline and may include a brief behavioral description. There are five performance domains included in this survey, as identified by the role delineation panel.

Task Statement*:* A task is an activity performed within a performance domain. Each performance domain consists of a series of tasks which collectively forms a comprehen-sive and detailed description of each performance domain. Typically, task statements answer such questions as: *What activity did you perform? To whom or to what was your activity directed? Why did you perform that activity? How did you accomplish the activity?*

Section C
Evaluation of Performance Domains

Instructions:

We ask that you rate each performance domain identified by the role delineation committee on three dimensions: Importance, Criticality, and Frequency. The five performance domains identified by the role delineation panel are:

1. Site Characterization and Interpretation
2. Remedy Selection and Implementation
3. Performance Evaluation
4. Verification
5. Professional Responsibility

Importance

Indicate how important each performance domain is to the performance of an licensed environmental professional. Rate each of the five domains using the scale below. Please assign each domain *only one* rating. DO NOT *RANK* THE DOMAINS. Select the number of the description below that best exemplifies your rating for each domain and write that number in the space provided next to each domain.

1 = ***Not Important.*** Performance of tasks in this domain is not essential to the job performance of the entry-level licensed environmental professional.

2 = ***Somewhat Important.*** Performance of tasks in this domain is minimally essential to the job performance of the entry-level licensed environmental professional.

3 = ***Important.*** Performance of tasks in this domain is moderately essential to the job performance of the entry-level licensed environmental professional.

4 = ***Very Important.*** Performance of tasks in this domain is clearly essential to the job performance of the entry-level licensed environmental professional.

5 = ***Extremely Important.*** Performance of tasks in this domain is absolutely essential to the job performance of the entry-level licensed environmental professional.

Performance Domain	***Rating of Importance***
Site Characterization and Interpretation	_____
Remedy Selection and Implementation	_____
Performance Evaluation	_____
Verification	_____
Professional Responsibility	_____

Criticality

Indicate the degree to which the inability to perform tasks in each performance domain would be seen as causing harm to an individual. "Harm" may be physical, emotional, or financial. Rate each of the five performance domains by using the scale below. Please assign each domain *only one* rating. DO NOT *RANK* THE DOMAINS. Select the number of the description that best exemplifies your rating for each domain and write that number in the space provided next to each domain.

1 = ***No Harm.*** Inability to perform tasks in this domain would have no adverse consequences.

2 = ***Minimal Harm.*** Inability to perform tasks in this domain would lead to error with minimal adverse consequences.

3 = ***Moderate Harm.*** Inability to perform tasks in this domain would lead to error with moderate adverse consequences.

4 = ***Significant Harm.*** Inability to perform tasks in this domain would lead to error with major adverse consequences.

5 = ***Extreme Harm.*** Inability to perform tasks in this domain would definitely lead to error with severe consequences.

Performance Domain	***Rating of Criticality***
Site Characterization and Interpretation	_____
Remedy Selection and Implementation	_____
Performance Evaluation	_____
Verification	_____
Professional Responsibility	_____

Frequency

Indicate the percentage of time (frequency) you devote to the tasks required to perform in each of the five domains. Write the percentage in the space provided next to each domain. *The total must equal 100 percent.*

Performance Domain	***Rating of Frequency (%)***
Site Characterization and Interpretation	_____
Remedy Selection and Implementation	_____
Performance Evaluation	_____
Verification	_____
Professional Responsibility	_____
TOTAL	*100 %*

Section D:
Evaluation of Performance Domains

In this section you will rate the task statements associated with each of the five performance domains on three dimensions –Importance, Criticality, and Frequency–according to the scales below:

Rating Scales

Importance	Criticality*	Frequency
1 - Not important	1 - Causing no harm	1 - Never
2 - Somewhat important	2 - Causing minimal harm	2 - Rarely
3 - Important	3 - Causing moderate harm	3 - Infrequently
4 - Very important	4 - Causing significant harm	4 - Frequently
5 - Extremely important	5 - Causing extreme harm	5 - Repetitively

****refers to the physical, emotional, financial, etc. harm that could be caused by the LEP's inability to perform the task competently.***

Circle the number corresponding to the Importance, Criticality, and Frequency rating for each skill statement.

Task Statements in Performance Domain 1. ***Site Characterization and Interpretation***	**Importance**	**Criticality**	**Frequency**
1. Research the site's physical characteristics, environmental setting, and history by inspecting it, reviewing published and reasonably available documents and files, interviewing relevant sources / persons, etc., in order to identify substances of concern and known and potential release areas.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Determine if additional investigation is necessary by assessing substances of concern and potential release areas in order to evaluate the likelihood of site contamination.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Develop a conceptual model of migration pathways for substances of concern stemming from potential release areas by identifying fate and transport characteristics in order to design a Phase II site investigation.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Design a Phase II investigation for sampling environmental media most likely to be contaminated by considering the conceptual model and selecting appropriate investigative techniques in order to determine if substances of concern are present.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Importance	Criticality	Frequency
1 - Not important	1 - Causing no harm	1 - Never
2 - Somewhat important	2 - Causing minimal harm	2 - Rarely
3 - Important	3 - Causing moderate harm	3 - Infrequently
4 - Very important	4 - Causing significant harm	4 - Frequently
5 - Extremely important	5 - Causing extreme harm	5 - Repetitively

	Importance	**Criticality**	**Frequency**
5. Conduct the Phase II investigation by collecting and analyzing data in order to validate or refine the conceptual model and provide an opinion regarding the presence of substances of concern.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6. Design Phase III investigations by considering the conceptual model and identifying data gaps in order to define the nature and extent of contamination and understand fate and transport of substances of concern.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Conduct Phase III investigations by collecting and analyzing data in order to validate or further refine the conceptual model and provide an assessment regarding the extent and degree of substances of concern.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8. Compare the results of the Phase III investigations to RSRs using the criteria set forth to determine compliance or the need for remedial actions.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Please list any tasks related to Domain 1 which you think may have been overlooked.

Importance	Criticality	Frequency
1 - Not important	1 - Causing no harm	1 - Never
2 - Somewhat important	2 - Causing minimal harm	2 - Rarely
3 - Important	3 - Causing moderate harm	3 - Infrequently
4 - Very important	4 - Causing significant harm	4 - Frequently
5 - Extremely important	5 - Causing extreme harm	5 - Repetitively

Task Statements in Performance Domain 2. ***Remedy Selection and Implementation***	**Importance**	**Criticality**	**Frequency**
1. Identify remedial action goals by applying the RSR and other regulations and by recognizing the site's physical characteristics, the schedule for achieving the goals, and current and future land use considerations in order to select remedial strategies.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Screen potential remedial strategies by reviewing technologies and alternative criteria, variances, and exceptions requiring Commissioner approval in order to identify the most promising remedial strategies.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Evaluate the feasibility of each promising remedial strategy by considering selection criteria such as the capability of the technology, the time required to achieve the goal, public acceptance, and cost in order to prioritize remedies and identify data needs for final selection.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Fill data needs by conducting bench-scale or pilot-scale tests, modeling, supplemental field sampling, etc., in order to allow selection of the final remedy.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5. Select the final remedy by reapplying selection criteria in light of newly acquired data in order to provide the basis for design and/or implementation.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Importance	Criticality	Frequency
1 - Not important	1 - Causing no harm	1 - Never
2 - Somewhat important	2 - Causing minimal harm	2 - Rarely
3 - Important	3 - Causing moderate harm	3 - Infrequently
4 - Very important	4 - Causing significant harm	4 - Frequently
5 - Extremely important	5 - Causing extreme harm	5 - Repetitively

	Importance	**Criticality**	**Frequency**
6. Collaborate with qualified professionals by communicating remediation objectives in order to achieve the final design and specifications for the remedy.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7. Monitor the remedy's implementation in collaboration with other qualified professionals, as necessary, by conducting field observations and testing, etc., in order to confirm consistency with design objectives and remedial goals.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Please list any tasks related to Domain 2 which you think may have been overlooked.

Importance	Criticality	Frequency
1 - Not important	1 - Causing no harm	1 - Never
2 - Somewhat important	2 - Causing minimal harm	2 - Rarely
3 - Important	3 - Causing moderate harm	3 - Infrequently
4 - Very important	4 - Causing significant harm	4 - Frequently
5 - Extremely important	5 - Causing extreme harm	5 - Repetitively

Task Statements in Performance Domain 3. ***Performance Evaluation***	**Importance**	**Criticality**	**Frequency**
1. Monitor performance of the remedy by making appropriate measurements and observations to determine if it is functioning as intended.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Monitor environmental media by sampling and testing to evaluate if the remedy is progressing toward the achievement of remedial goals.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Modify the remedy as necessary by responding to changed conditions indicated by monitoring data and / or revised remedial goals in order to enhance performance.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Please list any tasks related to Domain 3 which you think may have been overlooked.

Importance	Criticality	Frequency
1 - Not important	1 - Causing no harm	1 - Never
2 - Somewhat important	2 - Causing minimal harm	2 - Rarely
3 - Important	3 - Causing moderate harm	3 - Infrequently
4 - Very important	4 - Causing significant harm	4 - Frequently
5 - Extremely important	5 - Causing extreme harm	5 - Repetitively

Task Statements in Performance Domain 4. ***Verification***	**Importance**	**Criticality**	**Frequency**
1. Evaluate whether or not investigations have been performed in accordance with prevailing standards and guidelines by reviewing all existing data in order to make an appropriate verification decision.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Evaluate whether or not the site has been remediated in accordance with RSRs by reviewing all existing data in order to make an appropriate verification decision.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Verify that investigations have been performed in accordance with prevailing standards and guidelines and that the site has been remediated in accordance with the RSRs by rendering an opinion that no further action is necessary.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Please list any tasks related to Domain 4 which you think may have been overlooked.

Importance	Criticality	Frequency
1 - Not important	1 - Causing no harm	1 - Never
2 - Somewhat important	2 - Causing minimal harm	2 - Rarely
3 - Important	3 - Causing moderate harm	3 - Infrequently
4 - Very important	4 - Causing significant harm	4 - Frequently
5 - Extremely important	5 - Causing extreme harm	5 - Repetitively

Task Statements in Performance Domain 5. ***Professional Responsibility***	**Importance**	**Criticality**	**Frequency**
1. Pursue professional development by attending professional seminars, reading technical journals, etc., in order to maintain continuing competence.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2. Adhere to the Rules of Professional Conduct for LEPs as embodied in the regulations by acting with integrity at all times in order to hold paramount human health and the environment.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3. Perform only those activities necessary to support site characterization, remediation, and verification by adhering to prevailing standards of care in order to avoid excessive or duplicative activities.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4. Construct a project record by documenting factual information sufficient to support the actions taken and decisions made and to communicate findings to clients and regulatory bodies.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Please list any tasks related to Domain 5 which you think may have been overlooked.