Characterization of Emergency Preparedness at DOE Contractor Facilities

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CHARACTERIZATION OF EMERGENCY PREPAREDNESS
AT DOE CONTRACTOR FACILITIES

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FOREWORD

In 1980, the Pacific Northwest Laboratory (PNL) was contracted by the U.S. Department of Energy (DOE) to conduct a study to expand and upgrade the information/data base contained in a series of five reports that were prepared in the early to mid-1970s. These reports provided guidance on radiation protection instrumentation to be used for emergency assessment purposes. A characterization and evaluation of current experience as well as an assessment of current state-of-the-art emergency preparedness instrumentation was accomplished by PNL and the results are contained in this report. The unfolding of the Three Mile Island (TMI) experience in the context of emergency preparedness instrumentation provides a valuable key to significant considerations in this revision.

To characterize the current state of emergency preparedness, a detailed emergency preparedness questionnaire was sent to DOE field offices for transmittal to appropriate DOE contractors. A similar survey on emergency preparedness instrumentation had been conducted in 1970. Part One of this report is a review of the documents on emergency preparedness instrumentation in the 1970s and their applicability to state-of-the-art instrumentation. Part Two is a comparison between the 1970 and 1980 emergency preparedness surveys. Part Three is an in-depth look at emergency preparedness in DOE in the early 1980s. A table of contents is provided at the beginning of each part.

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EXECUTIVE SUMMARY

A study of emergency preparedness capabilities at DOE facilities was initiated by Pacific Northwest Laboratory (PNL) at the request of the Department of Energy (DOE) following the incident at the Three Mile Island (TMI) Nuclear Power Station.^(a) It was designed to parallel but expand on a study on emergency preparedness instrumentation that was conducted in 1970 by Pacific Northwest Laboratory.^(b) The 1970 survey findings, which were published in BNWL-1552 (Selby and Unruh 1971), led to the publication of four additional reports on performance criteria for radiological emergency instrumentation. Three of these reports--BNWL-1635 (Selby et al. 1972), BNWL-1742 (Anderson et al. 1974) and BNWL-1857 (Andersen et al. 1976)--addressed the criteria for emergency instrumentation at reactors, mixed oxide fuel fabrication plants, and fuel reprocessing plants, respectively. The fourth report, BNWL-1991 (Bramson et al. 1976), addressed evaluation testing and calibration methodology for these instruments.

Part One of this three-part report is a review of these documents as they relate to state-of-the-art instrumentation. A table that compares the performance criteria established in BNWL-1991 with applicable American National Standards Institute (ANSI) standards is provided in the Appendix to Part One.

A few areas of emergency preparedness that were addressed in the 1970 report are directly applicable to the 1980 survey. Part Two is a comparison of these areas to identify any trends in emergency preparedness at DOE facilities.

An emergency preparedness questionnaire was sent to 10 DOE field offices in August 1980. The following nine subject areas were addressed in the questionnaire: administration, security, transportation accidents, emergency medical capabilities, effluent monitoring, environmental surveillance, meteorological monitoring, communications, and quality assurance/control. The responses from 30 DOE contractors, representing seven DOE field offices, were tabulated and the results are analyzed in Part Three.

(a) The TMI incident occurred on March 28, 1979.

(b) Pacific Northwest Laboratory was called Battelle Pacific Northwest Laboratories with the acronym BNWL in the 1970s.

The characterization of the emergency response capabilities at DOE facilities has thus been performed with a comparison of instrument specifications, a comparison of 1970 and 1980 survey data, and an analysis of questionnaire responses. The results of each of these tasks are summarized here.

REVIEW OF BNWL DOCUMENTS ON PERFORMANCE CRITERIA FOR EMERGENCY PREPAREDNESS INSTRUMENTATION

The four BNWL documents that were published in the 1970s do not cover the current spectrum of DOE contractor facilities. BNWL-1635 is directed primarily to emergency preparedness instrumentation at power reactors but power reactor licensing is no longer part of the DOE responsibility. While the criteria are generally applicable to reactors operated by DOE contractors, a revision to BNWL-1635 should specifically address production and research reactors. The following current DOE contractor facilities were not included in the previous documents: transuranium facilities, radiological laboratories, accelerators, waste storage facilities, and metallic fuel fabrication facilities.

Many of the functional criteria for emergency meteorological instrumentation discussed in BNWL-1635, -1742, and -1857 still correspond to state-of-the-art measurements; however, several revisions are needed. Specifically, the models for atmospheric dispersion do not reflect present-day refinements and the guidance on atmospheric dispersion and dose assessment does not reflect state-of-the-art microcomputer technology.

Many of the instrument performance criteria given in the four BNWL documents differ from corresponding standards for emergency or routine-use radiological instrumentation given in current ANSI standards. The Appendix to Part One provides a comparison of performance criteria between BNWL-1991 and applicable ANSI standards for portable survey and contamination detection meters, installed radiation monitors and area monitors, effluent monitors, calibration techniques, criticality detection systems, alarm systems, and direct reading dosimeters. Several recommendations in the BNWL documents for the use of specific instrument types do not conform to present-day instrument availability and use. In addition, these documents do not reflect the current widespread

use of digital instruments. Therefore, there is a need to revise the BNWL documents to adequately reflect present day DOE facility types, instrument performance criteria, and state-of-the-art instrumentation.

COMPARISON BETWEEN 1970 AND 1980 EMERGENCY PREPAREDNESS CAPABILITIES

Although the 1980 survey was broader in scope than the 1970 survey, the two surveys requested similar data in the following areas:

- medical treatment arrangements
- liquid effluent monitoring
- monitoring environmental dose rates and contamination levels
- gaseous effluent monitoring at the point of release
- boundary and environs air monitoring
- meteorological measurements
- emergency communications.

Data from the corresponding areas of the two studies was compared to identify trends in emergency preparedness capabilities at Department of Energy [formerly Atomic Energy Commission (AEC)] facilities.

For data analysis purposes, AEC licensee facilities and AEC contractor facilities were considered separately in 1970. To obtain a valid comparison to the contractor-based 1980 survey, only the data on AEC contractor facilities was used. Since this approach significantly reduced the 1970 sample size, caution must be exercised in interpreting observed trends.

No distinctive overall trend in emergency preparedness emerged from the comparison between the 1970 and 1980 surveys. Approximately one-half of the criteria that were compared showed no change; i.e., there was no improvement or decline in the emergency preparedness response capabilities. Approximately 30% of the compared criteria indicated improvement and 20% indicated decline in emergency response capabilities.

There has been little reported change in the areas of medical treatment arrangements, gaseous effluent monitoring at the point of release, boundary and environs air monitoring, and meteorological measurements, with the following exceptions: 1) the performance of sampling and analysis of gaseous effluents showed a marked increase between 1970 and 1980 with a corresponding increase in

the sampling of gases as compared to the sampling of particulates, and 2) there was a marked decrease in the reported ability of the contractors to perform ground deposition and dispersion calculations for airborne effluents.

Liquid effluent monitoring showed an overall improvement between 1970 and 1980; more sites seemed to provide continuous monitoring of liquid effluents and the systems were reported to function during design basis accidents. There was a greater emphasis on intermittent monitoring of environmental dose rates in 1980, but a smaller percentage of respondents reported that health physics approval was required for system deactivation. Finally, although emergency communications systems remained essentially the same (except for an increased use of the "page-boy" call system), provisions for emergency communication channels to the local police, local government, and the public news media showed a decline from 1970 to 1980.

QUESTIONNAIRE ANALYSIS

Eight of the nine areas of emergency preparedness that were addressed in the 1980 questionnaire are covered separately in this section. Questions were asked concerning the other area, security, including questions about: training of security personnel, security equipment and performance testing, and agreements for assistance from city, state, and federal agencies. However, since no significant trends were observed from the responses to the security questions, no data was reported.

Administration

Questions concerning administration of emergency preparedness functions included assignment of responsibilities, training and drills, agreements with local support groups, and procedures for implementation of the emergency plan. Questionnaire responses indicated that the majority of DOE facilities had a designated emergency planner and emergency trainer, provided training and performed drills, and had procedures for implementing the emergency plan. However, on the basis of a small percentage of favorable responses in several areas, it is recommended that there be a review of the quality assurance programs for evaluating the emergency plans, the emergency response training programs, and the provisions for media, state, and federal cooperation during emergency conditions.

Offsite and Onsite Transportation Accidents

Aspects of emergency planning that applied to offsite transportation accidents included notification procedures, emergency training for law enforcement agencies, emergency drills, and an emergency classification system. The majority of DOE sites had a plan to assist in the management of an offsite transportation accident; one quarter of the sites established funds for this assistance. Nearly all the respondents notified DOE in the event of an offsite transportation accident. It is recommended, on the basis of questionnaire responses, that the performance of drills covering such areas as initial notification, use of radiation detection instruments, decontamination procedures, and recovery operations be reviewed. In addition, the majority of respondents requested that a uniform emergency classification scheme for transportation accidents be established.

All of the responding sites had procedures for reporting onsite radioactive materials shipment accidents. Although approximately one half of the facilities did not have radiation monitoring instruments or crews trained in their use aboard the onsite shipment vehicle, adequate response would probably be available during an accident due to the presence of trained radiation monitors onsite.

Emergency Medical Capabilities

Based on the responses to the questionnaire, although not all sites had formal agreements with medical facilities, DOE facilities had adequate arrangements for medical assistance in the treatment of contaminated patients. These arrangements included available radio communications to the medical facility and radiation-measuring instruments at the medical facility. However, it is recommended that the training programs for medical support staff be reviewed to ensure staff knowledge of radiation protection procedures.

Effluent Monitoring

The questionnaire covered liquid and gaseous effluent monitoring at the point of release and in the environment. Responses to inquiries about continuous detection and monitoring of liquid effluents at the point of release demonstrated adequate coverage in the areas of the recording of data, the

systems' connections to annunciators, proportionality of monitor flow to total flow, and monitoring of the total liquid effluent discharge. Similarly, the ability to analyze samples for radionuclides appeared to be adequate.

The majority of the facilities used both continuous monitoring and sampling and analysis of plant exhaust. It was possible to relate effluent concentrations to a source term in most cases, but not to ground deposition values.

It is recommended that the following areas be reviewed for all monitoring systems because some sites had no provisions for:

- quality assurance programs
- programs for preventative maintenance of equipment
- instrument calibration
- emergency back-up power
- health physics approval for system deactivation
- correction of measured activity for radioactive decay (this would not be a problem for long-lived nuclides)
- analysis of samples in a timely manner.

Environmental Surveillance

The majority of facilities used thermoluminescence dosimeters to measure environmental dose levels both onsite and offsite. Deposited contamination was generally determined using either portable survey instruments or media sampling followed by radiochemical analysis in the laboratory. The sites collected a wide variety of samples and they appeared to have adequate isotope identification capabilities. It is recommended that provisions for instrument calibration, emergency back-up power, health physics approval for deactivation of environmental-monitoring systems, and corrections for radioactive decay be reviewed.

Meteorological Monitoring

One-half of the contractors had meteorological measurement systems. The majority of these systems accurately measured horizontal wind direction and wind speed, determined the atmospheric stability class, and used computers for data analysis. The majority of these sites calibrated their systems and

reported some method to predict plume travel. However, optimum accuracy and reliability of the meteorological system was not assured at some sites. Based on questionnaire responses, it is recommended that the following procedures, which are required to adequately track a plume, be reviewed:

- measurement of vertical wind direction and speed
- the use of averaged meteorological measurements as opposed to instantaneous readings
- determination of atmospheric stability class (this describes plume dispersion characteristics).

Communications

All the facilities indicated that they possessed an adequate combination of communications equipment that would be available in an emergency. Drills and reviews of the communication networks were conducted. Almost all of the sites had established communication channels with DOE and a medical facility. However, in some cases, communication channels had not been established with all of the support services and authorities that may be called on during an emergency. In particular, a review should be conducted to ensure that communication channels have been established with the news media and the local government.

Quality Assurance/Control

An emergency quality assurance (QA) program is a planned program for verifying that each part of the emergency preparedness program is performed adequately and that the total program meets its purpose. Quality control (QC) encompasses all the quality assurance actions that are necessary to control the physical measurements of a device in accordance with predetermined requirements.

Questionnaire responses indicated that the majority of DOE facilities are not implementing acceptable QA and QC techniques. A complete review of QA and QC programs is recommended because of a general lack of:

- documented QA programs for emergencies
- designated QA staff members

- acceptance testing and vendor certification of instrument performance
- written procedures for calibration and operation of equipment and for sample collection, preservation, packaging, and labeling
- preventative maintenance schedules and operational checks for equipment
- performance of proper instrument calibration techniques
- procedures to check dose calculations
- auditing programs.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the current study, it is recommended that several steps be taken to update the earlier PNL reports on emergency preparedness instrumentation. This study will further enhance the emergency preparedness capabilities at DOE facilities by providing a basis for alleviating present weaknesses. In addition, other areas of emergency preparedness will require upgrading. Specific recommendations are as follows:

1. Update performance specifications and descriptions in DOE criteria documents to meet present state-of-the-art instrumentation and current standards. These criteria documents should be directed to current specific DOE facility types (e.g., production and research reactors, waste storage facilities, accelerators, fuel fabrication facilities, etc.).
2. Compare the instrument performance criteria to design basis accident (DBA) environmental conditions to ensure that emergency instruments will perform satisfactorily under accident conditions.
3. Ensure that adequate calibration and testing procedures are developed and adequate operations are being performed for emergency instrumentation.
4. Ensure that quality assurance programs have been established and quality control techniques are being performed, especially in the areas of effluent monitoring and environmental surveillance.

5. Ensure that provisions for media, local, state, and federal cooperation and assistance during emergencies have been established.
6. Ensure that emergency response training programs are adequate to provide an effective response.
7. Ensure that meteorological measurement capabilities are adequate and that documentation is provided that reflects state-of-the-art techniques for meteorological analysis.

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INTRODUCTION

At the request of the Atomic Energy Commission (AEC)^(a) and the Advisory Committee on Reactor Safeguards, Pacific Northwest Laboratory (PNL) conducted an emergency preparedness instrumentation survey in 1970 of 12 AEC-licensed power reactors, 11 AEC-owned sites, seven AEC-licensed nonpower reactors, two AEC-owned fuel reprocessing plants, and one AEC-owned plutonium fuel fabrication plant. The survey was initiated by questionnaire, and follow-up site visits were made to observe and discuss radiological emergency instrumentation. The study results were published in BNWL-1552 (Selby and Unruh 1971). The 1970 study demonstrated a need for performance criteria for radiological emergency instrumentation. Four documents were subsequently developed and issued:

1. BNWL-1635 - Emergency Radiological and Meteorological Instrumentation Criteria for Reactors (Selby et al. 1972)
2. BNWL-1742 - Emergency Radiological and Meteorological Instrumentation for Mixed Oxide Fuel Fabrication Facilities (Andersen et al. 1974)
3. BNWL-1857 - Emergency Radiological and Meteorological Instrumentation for Fuel Reprocessing Facilities (Andersen et al. 1976)
4. BNWL-1991 - Evaluation Testing and Calibration Methodology for Emergency Radiological Instrumentation (Bramson et al. 1976).

Following the Three Mile Island (TMI) nuclear power reactor incident in 1979, the Department of Energy (DOE) requested that PNL review the established performance criteria for emergency preparedness instrumentation and conduct a second survey of emergency preparedness at DOE contractor facilities. Subsequently, a detailed emergency preparedness questionnaire was prepared and sent to DOE contractors through the respective DOE field offices. Many of the aspects of emergency preparedness that were addressed by the 1980 questionnaire had been considered in the 1970 survey. Others were obtained from DOE Order 5500.2, "Emergency Planning, Preparedness, and Response for Operations," and applicable instrument standards. Other DOE orders applicable to emergency

(a) The Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA) were the predecessors of DOE.

preparedness include DOE Order 5500.3, "Reactor and Nonreactor Nuclear Facility Emergency Planning, Preparedness and Response Program for Department of Energy Operations," and DOE Order 5500.4, "Public Affairs Policy and Planning Requirements for Emergencies." A summary of DOE Order 5500.2, Attachment 2, "Emergency Planning, Preparedness, and Response for Operations - General Requirements," is provided as Appendix A of Part Three.

The questionnaire, which was sent out in August 1980 to 10 DOE field offices, consisted of 15 information modules for nine subject areas:

- administration
- security
- transportation accidents
- emergency medical capability
- effluent monitoring
- environmental surveillance
- meteorological monitoring
- communications
- quality assurance/control.

The questions were presented in modular form to permit personnel with expertise in each subject area to respond separately and to permit individual review of each subject module by qualified reviewers. Thirty questionnaires representing seven DOE field offices were completed and returned to PNL. The seven DOE field offices that participated in this study were: Albuquerque, Chicago, Idaho, Nevada, Oak Ridge, Richland, and San Francisco.

This report is presented in three parts. Part One is a review of the BNWL documents to determine whether they are applicable to state-of-the-art instrument capabilities. The Appendix to Part One provides a comparison between the instrument performance criteria established in BNWL-1991 to applicable American National Standards Institute (ANSI) standards for portable survey and contamination meters, installed radiation and area monitors, effluent monitors, calibration techniques, criticality detection systems, alarm systems, and direct reading dosimeters. Part Two compares the 1970 survey results with the 1980 survey results to identify trends in emergency preparedness. Part Three

is a discussion of the results of the 1980 emergency preparedness survey and the supporting data for each of the 15 modules. A detailed table of contents precedes each part.

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PART ONE

REVIEW OF BNWL DOCUMENTS ON PERFORMANCE CRITERIA
FOR EMERGENCY PREPAREDNESS INSTRUMENTATION

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PART ONE

REVIEW OF BNWL DOCUMENTS ON PERFORMANCE CRITERIA FOR EMERGENCY PREPAREDNESS INSTRUMENTATION

INTRODUCTION

Specific performance requirements, characteristics, and criteria for emergency instrumentation at three types of nuclear facilities, reactors, mixed oxide fuel fabrication facilities, and fuel reprocessing facilities, are provided in BNWL-1635, -1742, and -1857. Performance criteria from the three documents is summarized in BNWL-1991, and general testing and calibration procedures for performance verification are provided. The documents were reviewed for their applicability to DOE contractor facilities and to current state-of-the-art emergency preparedness instrumentation.

APPLICABILITY TO DOE FACILITIES

The entire spectrum of DOE contractor facilities is not covered in the performance criteria documents. A significant portion of the responses to the 1970 study addressed the state of emergency preparedness at power reactors and BNWL-1635 is directed primarily to these facilities. Power reactors as a group were removed from the spectrum of DOE involvement as a result of the reorganization of AEC. Although several contractors currently operate reactors, these are predominately production or research reactors. Thus, the revision of BNWL-1635 should be considered to more adequately address emergency instrumentation preparedness at production and research reactors. Furthermore, guidance was not provided in the original four documents for other current DOE facilities such as transuranium facilities, enrichment facilities, radiological laboratories, accelerators, waste storage facilities, or metallic fuel fabrication facilities. These operations currently make up the majority of DOE contractor facilities.

METEOROLOGICAL INSTRUMENTATION AND DOSE ASSESSMENT

Functional criteria for emergency meteorological instrumentation are provided in BNWL-1635, -1742, and -1857. Although many of the criteria in these documents are essentially state-of-the-art, several revisions are needed. First, BNWL-1635 specifically recommends installation of real-time, offsite, plume-monitoring instrument arrays in the vicinity of reactor containment. The value of such systems has become questionable in the light of recent assessments and they have been shown to be impractical from an economic standpoint (NUREG/CR-2644). Secondly, the models listed for atmospheric dispersion do not reflect refinements that can account for building wake effects, plume meander, and plume reorientation (NRC Regulatory Guide 1.145). Finally, the guidance on atmospheric dispersion and dose assessment does not reflect state-of-the-art microcomputer technology. Several microcomputer codes are available that provide enhanced meteorological data collection, processing, and display capability for emergency situations. The use of microcomputers and codes should be discussed in the guidance documents.

STATE-OF-THE-ART INSTRUMENTATION

The document review revealed some additional discrepancies between instruments described in BNWL documents and current state-of-the-art instruments. For example, BNWL-1742 indicates that a commercially available alpha air-sampling unit, incorporating ruggedized silicon surface barrier detectors or partially depleted diffused junction detectors, would be desirable but is not currently available. At the present time, several commercial vendors offer such a unit, and they are widely used throughout the industry. BNWL-1857 indicates that the Fidler low energy gamma survey instrument is the preferred instrument for rapid, in-field surveys for plutonium dispersal accidents. Although the Fidler instrument may still be in wide use, consideration should also be given to the use of phoswich-type detection systems, which probably represent the current state-of-the-art. Phoswich systems generally have lower background count rates and are thus more sensitive than the Fidler. Again, recent developments in portable alpha survey instruments, particularly in the

area of air-proportional detectors, permit lower limits of detection that are significantly less than the 500 dpm/100 cm² value listed in the BNWL documents. Lastly, the documents in general do not reflect the current widespread use of digital instruments, especially pocket alarm dosimeters.

COMPARISON WITH OTHER STANDARDS

Many of the instrument performance criteria given in the four BNWL documents differ in detail from the corresponding standards for emergency or routine-use radiological instrumentation given in current or proposed ANSI standards primarily because of the consensus process. While it is recognized that certain performance criteria are applicable only to emergency response instruments (e.g., higher dose rates, longer battery life), many performance criteria are generally applicable to all radiological instruments. In either case, the existence of several conflicting standards is confusing to contractor personnel who are responsible for emergency preparedness instrumentation.

The Appendix provides a summary of performance criteria for several broad classes of emergency instrumentation as specified in BNWL-1991. These criteria are compared to ANSI Standard N320-1979, Performance Specifications for Reactor Emergency Radiological Monitoring Instrumentation, and the draft ANSI Standard N42.17-1984, Performance Specifications for Health Physics Instrumentation. There are several significant differences between the respective criteria. Specific examples of differences for portable instruments, installed radiation monitors, and effluent monitors are listed below.

PORTABLE INSTRUMENTS

In BNWL-1991:

1. The specification for the low end of the beta dose rate range is a factor of 1000 lower than the ANSI standard value.
2. The allowable variation in response with photon energy is lower (more restrictive) than either the current or draft ANSI standards.

3. The overall system response time requirement is lower than the current or draft ANSI standard values.
4. The overall system accuracy is less restrictive than the draft standard.
5. Precision and stability criteria are not defined.

INSTALLED RADIATION MONITORS

In BNWL-1991:

1. The maximum signal for which an instrument will remain upscale is not specified.
2. Accuracy requirements are less restrictive than the draft ANSI standard values.
3. The specification for precision is more restrictive than the current ANSI value and less restrictive than the value in the draft standard.

EFFLUENT MONITORS

In BNWL-1991:

1. Accuracy is expected over the full range of the instrument while the ANSI standard expects accuracy over 80% of the range.
2. No confidence interval is specified for precision.

In addition, it is apparent that the BNWL criteria, which were developed prior to the standards, are not complete. For example, BNWL-1991 provides no criteria for precision, stability, temperature response, temperature range and humidity, extracamerall effects, magnetic field response, or seismic response for portable instruments.

CONCLUSIONS

The above discussion points out the need for revision of the BNWL documents on instrument performance criteria to 1) more accurately reflect the

composition of the DOE contractor family, 2) incorporate changes in meteorological modeling technology, 3) bring DOE standards for emergency radiological instruments into line, where technically appropriate, with current ANSI and other standards, and 4) reflect the current state-of-the-art emergency radiological instrumentation.

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APPENDIX

HEALTH PHYSICS INSTRUMENTATION
PERFORMANCE CRITERIA COMPARISON

APPENDIX

HEALTH PHYSICS INSTRUMENTATION PERFORMANCE CRITERIA COMPARISON

1. PORTABLE SURVEY AND CONTAMINATION METERS

Criteria	BNWL 1991 ^(a)	ANSI N320 ^(b)	Draft ANSI N42.17 ^(c)
Photon exposure rate range	0.1 mR/h to 10 ⁴ R/h	0.1 to 10 ⁴ R/h	0.1 mR/h to 1000 R/h
Beta dose rate range	0.01 mrad/h to 10 ⁴ rad/h	0.1 to 10 ⁴ rad/h	0.1 mrad/h to 1000 rad/h
Photon energy dependence	±15% from 30 keV to 3 MeV	±20% from 100 keV to 3 MeV	±20% from 0.08 to 1.5 MeV
Beta energy dependence	±30% from 0.1 to 3 MeV	±30% from 0.3 to 2 MeV E max (β)	±50% from 0.25 to 3.5 MeV
Overall system accuracy	±40% at 95% confidence interval	±40% at 95% confidence level	±15% at 95% confidence interval
Overall system response time	0 to 90% to full reading ≤2 sec	10 to 90% of true reading ≤3 sec	10 to 90% of final reading in time depending on range
Minimum battery lifetime	200 h at an exposure level of 10% maximum full scale above 0°C 100 h below 0°C	100 h at 10% of maximum reading between -30°C and +50°C	At least 100 h of continuous operation
Geotropism	≤2% of full scale reading	≤3% of full scale reading	≤3% of full scale reading

(a) BNWL-1991 (Bramson et al. 1976), Evaluation Testing and Calibration Methodology for Emergency Radiological Instrumentation.

(b) ANSI N320-1979, Performance Specifications for Reactor Emergency Radiological Monitoring Instrumentation.

(c) Draft ANSI N42.17-1984, Performance Specifications for Health Physics Instrumentation.

1. PORTABLE SURVEY AND CONTAMINATION METERS (contd)

Criteria	BNWL 1991	ANSI N320	Draft ANSI N42.17
Response to noise	Undetectable at ≤ 100 dB		Variation $\leq 15\%$ after vibration of 5 g in frequency range 10 to 33 Hz
Sensitivity	$\leq 5\%$ of midscale or decade	$\leq 5\%$ of midscale or midpoint of decade	
Angular dependence	$\pm 15\%$ in a 2π steradian frontal direction for photons at 1 ± 0.2 MeV	$\pm 15\%$ in a 2π steradian frontal direction for photons 0.6 to 1.3 MeV	$\pm 20\%$ for the solid angle at 2 energies (i.e., ^{137}Cs and ≤ 130 keV)
Overall instrument response	Shall not change more than $\pm 10\%$		
Altitude if used in airplane	Operate properly at 5000 ft above terrain	Should be able to operate at a selected altitude	
Integrating range if capability exists	Photon exposure: 0.1 to 10^3 R Beta dose: 0.1 to 10^3 rad		
Audible alarm on integrating units	A warbling tone with frequency of 2 to 7 kHz and sound level of 85 dBA at 50 cm		
Weight	The total weight including the power source shall not exceed 50 lb and be convenient for one person; survey meters including batteries shall not exceed 6.6 lb	Total weight of a fully assembled survey meter shall not exceed 7.7 lb if not hand held, total weight plus power source ≤ 50 lb	
High radiation		Remain full scale when off scale	Remain full scale up to 100 times upper detection limit for limits up to 10 R/h, 10 times the upper detection limit for limits > 10 R/h with minimum exposure rate of 1000 R/h

I. PORTABLE SURVEY AND CONTAMINATION METERS (contd)

Criteria	BNWL 1991	ANSI N320	Draft ANSI N42.17
Battery check	Instrument shall have a battery check switch and an indicator of battery condition	Instrument with battery check switch and battery condition indicator	Shall have a direct indicator of battery condition
Readout	Readout shall be direct and in units of dose or exposure per time; multiplier X10 and X100 should be included	Direct readout in units of dose or exposure per time shall be distinctly marked with X100 and X10 multipliers	Beta readout shall be in units of absolute dose rate or dose in air; neutrons shall be in dose equivalent or dose equivalent rate units; interim use of R or R/h for exposure or exposure rate acceptable; should be clearly marked with multipliers
Calibration	If used regularly, should be calibrated quarterly; if not, should be calibrated at least every 18 months	Shall conform to ANSI N323-1978	
Precision			Relative standard deviation of $\leq 10\%$
Stability		$\pm 3\%$ of full scale or decade for 3 hr after 10 min warmup	$\pm 3\%$ of full scale or decade over 3 h after 10 min warmup
Temperature response		Temperature coefficient $\leq 0.5\%/^{\circ}\text{C}$ and variations $\leq 15\%$ of value at 20°C	
Temperature range and humidity		5% to 100% relative humidity; operate between -30°C to $+50^{\circ}\text{C}$	Variation $\leq 15\%$ from 0 to 40°C compared to reading at 20°C ; variation $\leq 15\%$ from 40-95% R.H. compared to reading at 40% RH, 20°C
Extracamerai effects response		$< 1\%$ in photon field of 0.1 to 10^4 R/h at 1 MeV and β fields of air dose of 10 rad/h at 2 MeV E max (β)	$\leq 5\%$ of the range or decade for photon, β , and neutron; for external probe units only

1. PORTABLE SURVEY AND CONTAMINATION METERS (contd)

Criteria	BNWL 1991	ANSI N320	Draft ANSI N42.17
Magnetic field response		Unaffected up to 10 oersteds	Variation $\leq 15\%$ for fields to 240 A/M
Seismic	Undetectable change in response after vibration frequencies of 10 to 100 Hz with total excursion of 0.5 mm	Withstand harmonic g loadings along each axis of 1 to 33 Hz at >1 g or maximum g forces expected	Harmonic loadings of 5 g along orthogonal axes with frequency of 10 to 30 Hz
Other external effects		Radiofrequency up to 100 V/m; microwave exposure to 10 MW/cm ² ; electrostatic fields to 500 V/cm	Variation $\leq 15\%$ for r.f. fields ≤ 100 V/M at 60 Hz and 0.3 to 35 MHz, microwave fields ≤ 100 W/M ² , (915 MHz, 2450 MHz) and electrostatic fields ≤ 5000 V/M
Check circuits			An internal audit circuit should test both detector and electronics
Interfering ionizing radiations			Dose rate readouts for, α , β - γ count rate shall not respond to neutrons ≤ 1 rem/h; dose equivalent not respond to β - γ ≤ 10 rad/h or to α ; α count rate shall be nonresponsive to β or γ
Pressure			Variation $\leq 15\%$ from 70 to 106 kPa compared to 101 kPa

II. INSTALLED RADIATION MONITORS AND AREA MONITORS

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N320</u>	<u>Draft ANSI N42.17</u>
Checks	Internal electronic calibration check for nondetector circuitry	Should be functionally tested without removal of system	Internal audit circuit tests both electronics and detector
Malfunction signal	If malfunction or failure occurs a signal shall automatically be transmitted to a central manned location	Checks both detector and electronics and presents a signal to a central manned station	Checks both detector and electronics and produces a failure alarm at a central manned station
Power fluctuation	Operate at $\pm 20\%$ of 117 V 60 Hz AC with emergency power automatically initiating within 6 sec of power loss	103 to 130 VAC and 50 or 60 Hz ± 3 Hz as appropriate; automatically initiated emergency power which will return to normal	Variation $\leq 5\%$ over 115 ± 15 V or 230 ± 30 V at nominal frequency of 60 Hz compared to response observed when system operated at voltage recommended by manufacturer
High range radiation (off scale)	Shall not paralyze and shall remain full upscale	Shall remain full scale for up to 10 times maximum value and return in 1 min when ok	Remain full scale up to 100 times upper detection limit for limits of 10 R/h, 10 times the upper detection limit for limits >10 R/h with minimum exposure rate of 1000 R/h
Switches and controls	Shall be protected to prevent inadvertent deactivation or operation of system	Be protected to avoid inadvertent deactivation or maloperation	Protected to prevent inadvertent deactivation or maloperation of system
Accuracy	$\pm 40\%$ at 95% confidence interval	$\pm 40\%$ at 95% confidence interval	$\pm 15\%$ at 95% confidence interval
Precision	$\pm 10\%$ for any single measurement level	$\pm 15\%$ for any single measurement level	Relative standard deviation $\leq 10\%$
Response time	0 to 90% of full reading ≤ 2 sec	10 to 90% of true reading on maximum ≤ 3 sec, ≤ 5 sec for rest	10 to 90% of final reading in time depending on range

11. INSTALLED RADIATION MONITORS AND AREA MONITORS (contd)

Criteria	BNWL 1991	ANSI N320	Draft ANSI N42.17
External effects response	No deleterious effects from: radiofrequency, microwave $\leq 10 \text{ MW/cm}^2$; photons $\leq 5 \times 10^5 \text{ R}$ at 0.8 to 1.2 MeV; electrostatic potential $\leq 10^4$	No deleterious effects from: radiofrequency to 100 V/m microwave $\leq 10 \text{ MW/cm}^2$; photon $\leq 5 \times 10^5 \text{ rad}$ 0.6 to 1.3 MeV; In containment electrostatic field $\leq 500 \text{ V/cm}$	Extracameral: $\leq 5\%$ decade; radiofrequency $\leq 100 \text{ V/m}$; microwave: $\leq 100 \text{ W/m}^2$; Magnetic: $\leq 240 \text{ A/m}$ or 3 oersteds; electrostatic: $\leq 5 \text{ kV/m}$; should not respond to other low-level radiation
Temperature	Encompass extremes anticipated and use 50-yr extremes for outside	Operate in anticipated temperature use 50-yr extremes for outside ambient temperature	Variation of $\leq 15\%$ from 0 to 40°C compared to response at 20°C
Temperature response	$\leq 0.5\%/^\circ\text{C}$ and inside $\pm 15\%$ over entire range	$\leq 0.5\%/^\circ\text{C}$ and inside $\pm 15\%$ from reference at 20°C for a 60°C span	
Humidity	5% to 95% relative	40% to 95% from 15°C to 65°C or as anticipated	Variation of $\leq 15\%$ 40 to 95% RH at 20°
Pressure	A peak overpressure of 15 psi; if in containment, overpressure of 50 psi	Withstand up to design peak overpressure requirements for facility	Variation of $\leq 15\%$ 70 to 106 kPa compared to 101 kPa
Readout	Logarithmic or digital with automatic range changing; shall be located in control room emergency operations center and near detector	Logarithmic, quasi-logarithmic, and digital readout scales with automatic range changing and range shall be clearly displayed	β - γ in units of absorbed dose rates, neutron in units of dose equivalent rates; clearly marked readings with multipliers
Interchangeability	All units of similar function shall be interchangeable within type	All units of similar function including detectors, modules, readout, alarms, power supplies shall be interchangeable	

11. INSTALLED RADIATION MONITORS AND AREA MONITORS (contd)

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N320</u>	<u>Draft ANSI N42.17</u>
Accessibility	All units shall be accessible for test without removal from the circuit	Should be able to functionally test without removal of system	
Alarm	Shall have an alarm with external set to alarm at any point in the range	Equipped with alarms capable of being externally set to alarm at any selected point within stated range; shall be incapable of reset without active acknowledgment	Be capable of adjustment to any point in range; shall not be incapacitated by thresholds beyond range limits, and shall be protected from inadvertent or unauthorized adjustment
Operation		Continuously except during brief periods of maintenance; calibration or repair if other monitoring is provided	
Stability			Maximum drift of no more than $\pm 3\%$ of full scale or decade in 24 hr and $\pm 10\%$ in 30 days
γ energy dependence	$\pm 20\%$ from 30 keV to 3 MeV		$\pm 20\%$ from 0.8 to 1.5 MeV
β energy response	$\pm 30\%$ from 0.1 to 3 MeV		$\pm 50\%$ of true value from 0.25 to 3.5 MeV
Neutron energy response			$\pm 50\%$ to $+100\%$ of true value for stated energy range
Seismic			5 g harmonic from 10 to 30 Hz

III. EFFLUENT MONITORS

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N13.10^(a)</u>
<u>Gaseous Effluent</u>		
System Design	Remove a representative sample on a continuous basis	
Location	Close to the point of release, but no particulate-generating gas phase reactions, corrosion, or release of contaminants should be downstream to the sampler; sampling point shall be no less than 8 duct diameters and preferably 10 duct diameters from the injection point	
Probe	Multi-entry probe	
Isokinetic	1.0 ± 0.2 inlet velocity to duct velocity	
Particulate detection	A minimum range of 10^{-10} to 10^{-3} Ci/m ³ referenced to ⁹⁰ Sr-Y and based on gross β detection for particulates	A minimum level of detectability of 4×10^{-12} μ Ci/cc for ⁹⁰ Sr
Iodine detection	10^{-10} to 10^{-3} Ci/m ³ referenced to ¹³¹ I and based on the detection of the gamma energy of interest for iodines	A minimum level of detectability of 4×10^{-12} μ Ci/cc for ¹³¹ I
Gaseous detection	10^{-9} to 10^{-2} Ci/m ³ utilizing a flow through ion chamber for gross β activity	A minimum detectable level of 5×10^{-7} μ Ci/cc for ¹³³ Xe, and covers many other nuclides

(a) ANSI N13.10-1974, Specification and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents.

III. EFFLUENT MONITORS (contd)

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N13.10</u>
Shielding	Should be shielded from external radiation; a flow through ion chamber should have 15 cm (6 in.) of lead if located in containment	
Operation, maintenance and calibration	Operation checked quarterly and maintenance and calibration checked as indicated	
Sampling lines	Shall be kept short, ≤ 10 ft between sample point and filter, bends radii shall exceed 5 sampling line diameters, use stainless steel, be designed for streamline flow and plateout of radioactive material $\leq 5\%$	
Flow rate accuracy	Calibrated flow rate meter shall continuously verify flow rate and be accurate within $\pm 20\%$	Shall be calibrated to determine actual flow rate and be periodically recalibrated
Particulate filters	Membrane filters with pore size $\leq 5 \mu\text{m}$ with an efficiency of $\geq 99.5\%$ for particles with diameters $\geq 0.3 \mu\text{m}$	
Radiolodine filters	Charcoal impregnated with KI with a minimum efficiency of 99.5% and 24-h retention, a charcoal medium should follow	
Range	Detector capability shall overlap the range of routine monitoring	Should overlap with emergency range and have at least 10^4 minimum detectable levels
Sensitivity		Will be calculated by $n_s = 2 n_b / 2RC$ n_s = signal count/sec n_b = background counts/sec $2RC$ = 2 x instrument constant

III. EFFLUENT MONITORS (contd)

Criteria	BNWL 1991	ANSI N13.10
Accuracy	Overall system accuracy shall be $\pm 40\%$ at 95% confidence interval over entire operating range	Error not exceed $\pm 20\%$ of reading over upper 80% of its dynamic range defined by: $\% \text{ error} = \frac{R_t - R_r}{R_t} \times 100\%$ R_r = indicated quantity R_t = true quantity
Precision	Within $\pm 10\%$ for any single measurement level	Within $\pm 10\%$ at 95% confidence interval
Response time	Shall be ≤ 2 sec from 0 to 90% full reading	Less than the time required to maintain background readings within the required accuracy
Temperature	Encompass anticipated extremes	Capable of operating with less than 5% change in calibration from 0 to 60°C
Pressure	Withstand a peak overpressure of 15 psi, or in containment, a peak overpressure of 50 psi	Capable of continuous operation in 500 to 800 torrs with no calibration change and capable of operation from 500 to 2500 torrs
Humidity	Be unaffected from 5% to 95% relative humidity	Operate in relative humidities from 10 to 95%
Power requirements	Operate on 117 V 60 Hz AC and be unaffected by voltage or frequency changes $\pm 20\%$; emergency power shall automatically implement within 6 sec of AC power loss	Operate with voltage and power requirements of $\pm 15\%$ with reading variations not to exceed $\pm 5\%$
External effects	No deleterious effects from: radiofrequency; microwave $\leq 10 \text{ MW/cm}^2$; photons exposure $\leq 5 \times 10^5 \text{ R}$ from 0.8 to 1.2 MeV; electrostatic changes to 10,000 V	Radiofrequencies and microwave signals $\leq \mu\text{W/cm}^2$ shall result in no more than $\pm 5\%$ at minimum detectable level

III. EFFLUENT MONITORS (contd)

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N13.10</u>
Radiation alarm	Can be externally set to alarm at any point over stated range	Can be externally set to annunciate at any point over the stated range
Failure alarm	An internal audit circuit shall alarm in a manned location for a failure	Shall have an alarm device to indicate a failure of the system
Calibration		Performed at least once using a radionuclide known concentration
<u>Liquid Effluents</u>		
Detection in liquids	Small NaI(Tl) crystal detector and photomultiplier optically coupled and hermetically sealed into an integral container - can operate submerged	Based on table listed in standard for nuclides present
Shielding	Thickness of material around the detector shall be at least 400 mg/cm^2 with preferred 1000 mg/cm^2 and photomultiplier should be able to operate in magnetic fields due to mu metal shielding	
Resolution	$\pm 12\%$ FWHM or better for the 1.17 MeV photon peak of ^{60}Co decay	
Range	Gross activity from 10^{-9} to 10^{-4} Ci/m^3 for photons $> 0.6 \text{ MeV}$ and assuming 0.5 photons/disintegration	Should overlap with emergency range and have a range of at least 10^4 from minimum detectable level
Accuracy of flow meter	Within $\pm 20\%$	Shall be calibrated to determine the actual flow rate and be periodically recalibrated

III. EFFLUENT MONITORS (contd)

Criteria	BNWL 1991	ANSI N13.10
Volume monitor	Monitor a static or nearly static volume of liquid or alternative liquid level	
Sensitivity		Will be calculated by $n_s = 2 n_b / 2RC$ n_s = signal count/sec n_b = background counts/sec $2RC$ = 2 x Instrument constant
Accuracy	Overall system accuracy shall be $\pm 40\%$ at 95% confidence interval over entire operating range	Error not exceed $\pm 20\%$ of reading over upper 80% of its dynamic range defined by: $\% \text{ error} = \frac{R_t - R_r}{R_t} \times 100\%$ R_r = Indicated quantity R_t = true quantity
Precision	Within $\pm 10\%$ for any single measurement level	Within $\pm 10\%$ at 95% confidence interval
Response time	Shall be ≤ 2 sec from 0 to 90% full reading	Less than the time required to maintain background readings within the required accuracy
Temperature	Encompass anticipated extremes	Capable of operating with less than 5% change in calibration from 0 to 60°C
Pressure	Withstand a peak overpressure of 15 psi, or in containment, a peak overpressure of 50 psi	Capable of continuous operation in 500 to 800 torrs with no calibration change and capable of operation from 500 to 2500 torrs
Humidity	Be unaffected from 5% to 95% relative humidity	Operate in relative humidities from 10 to 95%

III. EFFLUENT MONITORS (contd)

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N13.10</u>
Power requirements	Operate on 117 V 60 Hz AC and be unaffected by voltage or frequency changes $\pm 20\%$; emergency power shall automatically implement within 6 sec of AC power loss	Operate with voltage and power requirements of $\pm 15\%$ with reading variations not to exceed $\pm 5\%$
		<u>ANSI N323(a)</u>
External effects	No deleterious effects from: radiofrequency; microwave $\leq 10 \text{ MW/cm}^2$; photons exposure $\leq 5 \times 10^5 \text{ R}$ from 0.8 to 1.2 MeV; electrostatic charges to 10,000 V	Radiofrequencies and microwave signals $\leq \mu\text{W/cm}^2$ shall result in no more than $\pm 15\%$ at minimum detectable level
Radiation alarm	Can be externally set to alarm at any point over stated range	Can be externally set to annunciate at any point over the stated range
Failure alarm	An internal audit circuit shall alarm in a manned location for a failure	Shall have an alarm device to indicate a failure of the system
Calibration		Performed at least once using a radionuclide known concentration

IV. CALIBRATION TECHNIQUES

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N323</u>
Photon calibration sources	Use radionuclides, filtered X-rays, and K-fluorescent X-rays	Use radionuclides, filtered X-rays and K-fluorescent X-rays with a wide energy range

(a) ANSI N323-1978, Radiation Protection Instrumentation Test and Calibration.

IV. CALIBRATION TECHNIQUES (contd)

Criteria	BNWL 1991	ANSI N323
β-particle calibration sources	Use accelerator or radioactive sources such as ⁹⁰ Sr or natural uranium with a surface dose rate ≈225 mrad/h	Use ⁹⁰ Sr or U ₃ O ₈ being sufficiently strong so it can be detected far enough away to make end window small when compared to distance of source
α-particle calibration sources	Most are calibrated using radionuclide sources, plutonium, uranium, polonium or other α emitters, not point sources	Use radionuclide ¹⁴⁸ Gd, ²³⁰ Th, ²³⁹ Pu, ²¹⁰ Po, ²⁴¹ Am, ²³⁸ Pu, ²⁴⁴ Cm, or ²⁵² Cf
Neutron calibration sources	Calibrations may be accomplished with both isotopic neutron sources or neutron generating equipment; frequent sources include radium beryllium, polonium beryllium, americium beryllium, plutonium beryllium, antimony beryllium, and plutonium fluoride	Neutrons can be generated by (α, n), (γ, n), spontaneous fission, or by interaction with accelerated charged particle; sources for (α, n) or (γ, n) reactions generally consists of an α or γ emitter with beryllium
Temperature, pressure, and humidity	If temperature varies by more than 30°C from calibrated, the instrument should be calibrated over the expected temperature range; Instrument shall be calibrated over the expected pressure and humidity during operation	If temperature varies by more than 30°C from calibrated, the instrument should be calibrated over the expected temperature range; Instrument shall be calibrated over the expected pressure and humidity during operation
Directional dependence	Correction factors should be developed for different orientation relative to source	Correction factors should be developed for different orientation relative to source
Recalibration	After maintenance on or adjustment of instrument	After maintenance on or adjustment of instrument plus when instrument is subject to hand usage or corrosive environments

IV. CALIBRATION TECHNIQUES (contd)

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N323</u>
Performance field checks	Use check source to test instrument and if reference reading differs $>\pm 20\%$ discrepancy should be corrected	Use check source to test instrument and if reference reading differs $>\pm 20\%$ discrepancy should be corrected
Electronic calibrations	Electronically simulate radiation calibrations by 1) establishing a reference point with an appropriate radiation source, 2) match reference point with a nuclear pulse generator or current source, 3) vary pulse rate or current value to provide calibration check points	
Primary photon calibration standard	Allowable error shall depend on state of the art	
Primary β , α and neutron calibration standard	Allowable error shall meet the state of the art	
Secondary photon standard	Allowable error of $\pm 2\%$ for exposure	
Secondary beta standard	Allowable error of $\pm 5\%$ for dose	
Secondary neutron standard accuracy	Allowable error of $\pm 5\%$ for dose	
Laboratory photon standard accuracy	Allowable error of $\pm 5\%$ for exposure	
Laboratory beta standard accuracy	Allowable error of $\pm 10\%$ for dose	
Laboratory neutron standard accuracy	Allowable error of $\pm 10\%$ for dose	
Field photon standard accuracy	Allowable error of $\pm 20\%$ for exposure	

IV. CALIBRATION TECHNIQUES (contd)

<u>Criteria</u>	<u>BNWL 1991</u>	<u>ANSI N323</u>
Field beta standard accuracy	Allowable error of $\pm 25\%$ for dose	
Field neutron standard accuracy	Allowable error of $\pm 25\%$ for dose	
Emergency photon standard accuracy	Allowable error of $\pm 40\%$ for exposure	
Emergency beta standard accuracy	Allowable error of $\pm 40\%$ for dose	
Emergency neutron standard accuracy	Allowable error of $\pm 40\%$ for dose	
Precision	Shall be determined prior to calibration within $\pm 10\%$ of mean	Determined prior to calibration and be within $\pm 10\%$ of the mean
Linear readout instruments	Calibration shall be checked near ends of each scale $\approx 20\%$ and 80% of full scale	Be checked near ends of each scale at $\approx 20\%$ and 80% of full scale
Logarithmic readout instruments	Minimum calibration of one point near midpoint of each decade	Minimum calibration of one point near midpoint of each decade
Digital readout instruments	Calibrated at $\approx 20\%$ and 80% of each scale	At $\approx 20\%$ and 80% of each scale for scale switching readouts and at midpoint of each decade for nonswitching
Radiation energy	Calibrations shall be made at several energies over the energy range	At expected energies, or at several energies over range; an energy versus sensitivity curve will be plotted for energy dependence
Performance check frequency	Prior to intermittent use or several times a day during continuous use	Prior to intermittent use or several times a day during continuous use
Discrimination against unwanted radiation		Effects of radiation should be determined for all unwanted radiation

V. CRITICALITY DETECTION SYSTEMS

Function	BNWL 1991	ANSI/ANS 8.3 ^(a)
Maximum yield	3×10^{19} fissions	2×10^{19} fissions
Duration of transient	1 msec to 3 sec	≥ 1 msec
Radiation detected	Neutron	Uniform throughout system
Coverage		≥ 700 g ^{235}U , 520 g ^{233}U , 450 g ^{239}Pu , or 450 g of any combination
System response time	500 msec	
Spike threshold	10^{14} fissions	20 rad at 2 m in 60 sec

VI. ALARM SYSTEMS

Function	BNWL 1991	ANSI/ANS N2.3 ^(b)
Uniqueness of signal	Unique, not used for any other purpose	Unique, not used for any other purpose
Minimum sound level	10 dB above background, 75 dB in all locations	10 dB above background, 75 dB in all locations
Maximum sound level		115 dB at the ear of an individual
Alarm termination		Limited to authorized personnel
Frequency	4 to 5 hertz	4 to 5 hertz

(a) ANSI/ANS 8.3-1979, Criticality Accident Alarm System.

(b) ANSI/ANS N2.3-1979, Immediate Evacuation Signal for Use in Industrial Installations.

VII. DIRECT READING DOSIMETERS

Function	BNWL 1991	ANSI N13.5 ^(a)
Range	Maximum permitted exposure shall be in the range of 40 to 70% of full scale reading	
Scale division	0, 50 and 100% of full scale with further divisions into tenths and twentieths	Divided into at least 10 and not more than 25 divisions with every fifth scale marked
Leakage	≤2% of full scale in a 24-h period	≤2% of full scale in a 24-h period
Accuracy	±25% of the true exposure at the 95% confidence level	±12% at the 95% confidence level
Precision	±10% at any level	
Energy dependence	±20% for photons in the range of 35 keV to MeV	Shall not exceed ±10% of the value of the sensitivity at one specified energy
Relative humidity	Instrument shall be unaffected by relative humidities from 5% to 95%	Shall meet accuracy specification at relative humidities from 0% to 90%
Temperature	Temperature coefficient shall be ±0.5% per °C, ±15% over the entire range	Shall meet accuracy specification at temperature between -10°C and +50°C
Rate dependence	Instrument shall be rate independent to 10 ⁶ R/sec	
Radiofrequency	No deleterious effect	
Microwave exposure	No deleterious effect to 10 mW/cm ²	
Photon exposure	No deleterious effect to 5 x 10 ⁵ R references to 0.5 to 1.2 MeV	
Magnetic fields	Unaffected up to 10 oersteds	

(a) ANSI N13.5-1972, Performance Specifications for Direct Reading and Indirect Reading Pocket Dosimeters for X- and Gamma Radiation.

VII. DIRECT READING DOSIMETERS (contd)

Function	BNWL 1991	ANSI N13.5
Mechanical shock	Shall be able to withstand shock equivalent to a drop from 3 ft onto a hard surface; such a shock shall not change reading by more than $\pm 10\%$	Shall not be permanently damaged when dropped from a height of 4 ft
Geotropism	$\pm 2\%$ of full scale	$\pm 5\%$ of full scale
Angular dependence	$\leq 15\%$ over the energy range 35 keV to 2 MeV	Response shall not be less than 70% of the true reading at every angle less than 50°
Sensitivity	$\leq 5\%$ of midscale	
Beta sensitivity	Nonresponsive to beta radiation with energies ≤ 2 MeV; or accurate to $\pm 30\%$ for betas from 100 keV to 2 MeV	
Marking		Manufacturer's name should appear on each instrument; each instrument shall be individually stamped
Exterior surfaces		Hard and smooth, with as few joints as possible
Atmospheric pressure		Shall meet accuracy specification from 456 to 912 mm Hg
Transient movement of pointer		Shall not exceed 5% of full scale (500-mR range) or 2% of full scale (500-mR range)

PART TWO

COMPARISON BETWEEN 1970 AND 1980 EMERGENCY PREPAREDNESS CAPABILITIES

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PART TWO

COMPARISON BETWEEN 1970 AND 1980 EMERGENCY PREPAREDNESS CAPABILITIES

INTRODUCTION

As discussed in the introduction to this document, a survey was conducted in 1970 to gather information concerning emergency instrumentation capabilities at 30 AEC licensee and contractor facilities (19 licensees and 11 contractors). Although the 1980 survey included many areas of emergency preparedness, the two surveys sought similar data in the following areas:

- medical treatment arrangements
- liquid effluent monitoring
- monitoring environmental dose rates and contamination levels
- gaseous effluent monitoring at the point of release
- boundary and environs air monitoring
- meteorological measurements
- emergency communications.

Data from the corresponding areas of the two studies is compared in this section to identify trends in emergency preparedness capabilities at Department of Energy (formerly AEC) facilities.

DATA COMPARISON METHODOLOGY

For data analysis purposes, AEC licensee facilities and AEC contractor facilities were considered separately in 1970. To obtain a valid comparison to the contractor-based 1980 survey, only the data on AEC contractor facilities is used here. Since this approach significantly reduces the 1970 sample size, caution must be exercised in interpreting the percentages that are given as the basis for comparison in this section.

An additional data breakdown was performed in both 1970 and 1980 that categorized the contractor facilities into high, medium, and low hazard classifications, based on the severity of potential accidents.^(a) Table 2.1 gives the total number of contractors in each category for the 1970 and 1980 surveys.

TABLE 2.1. Total Number of Contractors - 1970, 1980

<u>Hazard Classification</u>	<u>1970</u>	<u>1980</u>
High	3	10
Medium	5	6
Low	<u>3</u>	<u>14</u>
TOTAL	11	30

In this part of the report, the percentage of the total number of contractors that responded favorably (i.e., "yes" responses) to a given question are compared for 1970 and 1980. These percentages are presented in the tables. If the percentage of favorable responses in the high-hazard-potential classification is significantly different from the total percentage, or if it is of significant interest, this fact is noted in the text.

The percentages reported in this section were computed on the basis of applicable responses as determined by questionnaire responses and professional judgment. The 1970 study did not specifically state the number of "not applicable" responses for each question; this information could be deduced from follow-up questions to a main question. The percentage of favorable responses to a follow-up question are based on the number of applicable responses that were identified by the main question. In the tables presented in this part, follow-up questions to a main question are so noted. The 1980 survey, on the other hand, allowed the contractor to check "not applicable;" thus, all of the reported percentages were calculated on the basis of applicable responses. Therefore, the reported percentages are not always based on the total number of

(a) Hazard potential was keyed to the magnitude of the radioactive materials inventory at each site rather than to the probability of an accident occurring.

contractor facilities surveyed (11 in 1970, 30 in 1980) but rather on the number of facilities for which the questions were applicable.

In the comparison of similar questions in 1970 and 1980, there are cases where differences in wording may be significant. These differences are noted in the tables.

MEDICAL TREATMENT ARRANGEMENTS

The 1970 questionnaire contained 25 questions related to medical treatment facilities, six of which correspond to the Module 5 questions in the 1980 survey. Table 2.2 gives the total percentage of "yes" responses in 1970 and 1980 for each of these six areas.

TABLE 2.2. Medical Treatment Arrangements

Criteria	Percentage of Yes Responses ^(a)	
	1970	1980
Medical treatment facilities on-plant	82	85 (onsite industrial first aid stations) ^(b)
Medical assistance arrangements	91	88 (formal agreement)
Radiation detection and monitoring equipment at medical facility	100	100
Training sessions for medical support personnel	36	52 (offsite medical support personnel)
Offsite medical support staff qualified in radiation protection	100	73
Health physics support provided from plant	91	96

(a) These are percentages of applicable (Yes, No) responses to each question. "Not Applicable" responses are not tabulated.

(b) Differences in question wording in 1980 are noted in parentheses below the percentage. This approach is used throughout this part.

There has been little change in the availability of on-plant medical treatment facilities, medical assistance, radiation measurement equipment, or health physics support. Note that the training of medical support personnel, which was an area of concern in 1970 (36%), is still an area of concern in 1980 (52%). In 1980, 73% of the applicable respondents judged the medical support personnel to be qualified in the area of radiation protection but only 8% definitively stated that they were not qualified. The remaining 19% did not answer the question, which may indicate a hesitancy to make such a judgment.

LIQUID EFFLUENT MONITORING

The 1970 survey used two categories for liquid effluent measurements-- point of release, and boundary and environs. Nine of the questions are directly comparable to the 1980 survey (Module 6) and are presented in Table 2.3. In all cases, the percentage of favorable responses increased in 1980.

In 1970, 67% (two out of three) of the high-potential sites performed continuous monitoring of liquid effluents at the point of release and all performed sampling and analysis. In 1980, 56% (five out of nine) of the high-potential sites performed continuous monitoring and all performed sampling and analysis. It is noted that the term DBA (design basis accident) caused some confusion in 1970 and in 1980^(a) as did the distinction between monitoring and sampling.

Both of the criteria that were comparable for the boundary and environs monitoring system were of concern in 1970 and 1980. Health physics (HP) (or equivalent) approval should be mandatory for the deactivation of any monitoring system. Only one facility in the high-potential class responded to this question in 1970 (it was a favorable response) and only 50% of this class responded favorably in 1980 (the other applicable respondents did not answer).

(a) A question mark appears under the low-hazard-potential class in the 1970 report and question marks were found next to the term in a few of the 1980 questionnaires.

TABLE 2.3. Liquid Effluent Monitoring

<u>Criteria</u>	<u>Percentage of Yes Responses^(a)</u>	
	<u>1970</u>	<u>1980</u>
<u>Point of Release</u>		
Continuous monitoring of liquid effluents	27	48
percentage of above with remote readout	67	82 (annunciator at manned location)
Sampling and analysis (continuous and/or grab)	100	100
proportional sample	55	70
System would function during DBA	27	92
Emergency power available	36	77
Health physics approval required for system deactivation	55	100
<u>Boundary and Environs</u>		
Health physics approval required for system deactivation	45	67
System would function during DBA	55	67

(a) These are percentages of applicable (Yes, No) responses to each question. "Not Applicable" responses are not tabulated.

Similarly, only 50% of the high-potential class in 1980 was confident that the system would operate under DBA conditions while 67% of this class was confident of operation in 1970.

MONITORING ENVIRONMENTAL DOSE RATES AND CONTAMINATION LEVELS

The measurement of environmental dose rates, integrated doses, and environmental depositions, were covered under one heading (Miscellaneous

Measurements in the Environs) in the 1970 survey. The majority of questions dealt with dose rate monitoring and are compared to Module 9 of the 1980 survey. Questions dealing with contamination levels are compared to Module 10.

Fifty-five percent of the contractors had environmental dose-rate-monitoring capabilities in 1970 and 91% of the contractors had such capabilities in 1980. The percentages reported in Table 2.4 are out of these 55% and 91%, respectively.

TABLE 2.4. Environmental Dose Rate Monitoring

Criteria	Percentage of Yes Responses ^(a)	
	1970	1980
Continuous monitoring	67	22
Intermittent monitoring	33	78
Emergency power available	50	36
Health physics approval required for system deactivation	83	50
System would function during DBA	67	63

(a) These are percentages of applicable (Yes, No) responses to each question. "Not Applicable" responses are not tabulated.

One high-potential, three medium-potential, and one low-potential site reported no dose rate monitoring in 1970 while only two low-potential sites were not monitoring dose rates in 1980. Intermittent monitoring for the high-potential sites (1980) refers to monthly, quarterly, and annual measurements. Types of detectors used, such as GM tubes, ion chambers, scintillators, and thermoluminescence dosimeters, were basically the same in both studies. The percentage of facilities requiring 1) health physics approval for system deactivation, and 2) a functioning system under accident conditions, was lower in 1980 than in 1970.

Contamination levels in the environs were measured primarily by sample collection and analysis (soil, milk, water, vegetation) in both studies.

Although the survey results did not offer sufficient information for comparing sample analysis methods, both surveys indicated that a large percentage of facilities had isotope identification capabilities.

GASEOUS EFFLUENT MONITORING AT THE POINT OF RELEASE

In the 1970 study, many AEC contractors reported data on stack gaseous effluent instrumentation for several facilities at their site. This resulted in a total of 23 contractor facilities rather than the 11 reported in other sections of this report. Twelve questions are used in Table 2.5 as the basis for comparison between the 1970 and 1980 surveys (Module 7, 1980).

TABLE 2.5. Gaseous Effluent Monitoring at the Point of Release

Criteria	Percentage of Yes Responses ^(a)	
	1970	1980
Continuous monitoring system	87	92
Sampling and analysis	78	96
percentage of above that sampled		
gases	50	84
particulates	89	92
Possibility of unfiltered release under accident conditions	70	60
Sample proportional to effluent flow	65	56
Radionuclide concentrations converted to ground deposition	74	88
Emergency power available	74	83
percentage of above with		
automatic power	94	83
manual power	6	4
HP approval needed for system deactivation	91	76
Systems would function during DBA	52	45

(a) These are percentages of applicable (Yes, No) responses to each question. "Not Applicable" responses are not tabulated.

Four out of five high-potential sites in 1970 performed both continuous monitoring and sampling and analysis but only one facility sampled both gases and particulates. All of the high-potential sites performed both continuous monitoring and sampling and analysis in 1980 and eight out of nine sampled both gases and particulates.

The possibility of a release of radionuclides through unfiltered exhausts was attributed in several cases in 1970 to the release of room air (which may be adversely affected in an accident) through separate vents not equipped with filtration devices. An unfiltered release was possible at 60% of the high-potential sites in 1970 and 44% of these sites in 1980.

The percentage of facilities that reported using isokinetic sampling techniques decreased from 1970 to 1980. Again, two items of concern are the failure to require HP approval for system deactivation and the possibility of a system malfunction during a DBA at approximately one half of the sites in both 1970 and 1980.

BOUNDARY AND ENVIRONS AIR MONITORING

In 1970, 64% (7 out of 11) of the contractor facilities had instrumentation to measure radioactivity in the air at or within the boundary (any location onsite but away from the source facility) and all of the facilities reported the capability to measure radioactivity in the air in the environs (locations outside the boundary). The data for both boundary and environs instrumentation was combined in 1970. Module 8 of the 1980 survey, which addresses radioactive particulates and gases in the environment within the site boundaries, is used as the basis for comparison.^(a) Table 2.6 presents a comparison of the related questions.

The percentage of contractors performing continuous monitoring (approximately 40%) compared to sampling and analysis (100%) remained essentially constant between 1970 and 1980, but the monitoring and sampling of gases

(a) Module 9 (1980) addresses the monitoring of environmental dose levels but is not directly applicable to the environs measurements of the 1970 study.

TABLE 2.6. Boundary and Environs Air Monitoring

Criteria	Percentage of Yes Responses ^(a)	
	1970	1980
Continuous monitoring	36	42
percentage of above that monitored		
gases	50	70
particulates	100	80
Sampling and analysis	100	100
percentage of above that sampled		
gases	45	63
particulates	100	96
Emergency power available	27	38
System would function during DBA	27	37

(a) These are percentages of applicable (Yes, No) responses to each question. "Not Applicable" responses are not tabulated.

increased slightly. Less than 40% of the sites in 1970 and 1980 could provide emergency power or the assurance of a functional system during a DBA.

METEOROLOGICAL MEASUREMENTS

All of the contractor facilities reported having meteorology programs in 1970 although 36% (4 out of 11) of these were conducted by commercial contractors. Fifty percent (15 of 30) of the 1980 respondents provided their own meteorology programs and answered the questions in Module 11, Meteorology Station Instrumentation. The meteorological program for the remaining 50% of the sites was provided commercially or by other contractors and was not reported on in 1980. Thus, the percentages given in Table 2.7 reflect the answers of all of the 1970 contractors and the 50% of the 1980 contractors who provide their own program.

Wind direction and wind speed measurements were made by all the responding contractors in both 1970 and 1980. The capability to calculate plume

TABLE 2.7. Meteorological Measurements

Criteria	Percentage of Yes Responses ^(a)	
	1970	1980
Wind direction measurements	100	100
Wind speed measurements	100	100
Dispersion and deposition calculation capability	91	73
Remote readout	45	40 (continuously at manned location)
Facility operating procedures dependent on meteorological observations	27	53
Plan to make measurements from aircraft	36	20
Plan to predict plume travel	91	80
Emergency power available	45	67

(a) These are percentages of applicable (Yes, No) responses to each question. "Not Applicable" comments are not tabulated.

dispersion and ground deposition appears to have decreased significantly from 1970 (91%) to 1980 (73%), but all of the 1980 high-potential sites did report this capability. Also, the 1980 respondents who did not say "yes", did not say "no" either; they simply did not answer the question.

Approximately one-half of the sites in 1970 and 1980 had remote readout capabilities for the meteorological data, although this percentage could be higher for the 1980 contractors since the question specified a continuous readout at a manned location. Sixty-seven percent of the high-potential sites in 1970 planned to use aircraft for air monitoring but none of the high-potential sites in 1980 had such plans. All of the high-potential sites in both 1970 and 1980 had plans to predict plume travel.

EMERGENCY COMMUNICATIONS

All of the questions on the 1970 survey corresponded to questions in Module 12, Communication Arrangements, of the 1980 survey. Table 2.8 summarizes the reported data for both surveys. Eleven contractor facilities in 1970 and 28 facilities in 1980 (93% of 30) were applicable respondents.

TABLE 2.8. Emergency Communications

Criteria	Percentage of Yes Response ^(a)	
	1970	1980
Available equipment:		
two-way radios	100	96
"page-boy" call system	45	82
walkie-talkie	73	79
Communication channels established with:		
local police department	91	79
local government	100	54
medical center	82	93
management staff	82	93
public information media	73	61
Emergency communication plans routinely tested	82	93

(a) These are percentages of applicable (Yes, No) responses to each question. "Not Applicable" are not tabulated.

There has been little change in the types of communications equipment available with the exception of the "page-boy" call system, which has shown a significant increase in use. Established communications channels with the local police department, local government authorities, and public information media showed a decline between 1970 and 1980. All high-potential sites in 1970 routinely tested the communications network, but in 1980 only 88% (7 out of 8) did so.

CONCLUSIONS

A distinctive overall trend in emergency preparedness did not emerge from the comparison between the 1970 and 1980 surveys. Approximately one-half of the criteria that were compared showed no change in the emergency preparedness response capabilities. Approximately 30% of the compared criteria depicted an improvement and 20% depicted a decrease in emergency response capabilities.

There has been little change in the area of medical treatment arrangements, gaseous effluent monitoring at the point of release, boundary and environs air monitoring, and meteorological measurements, with the following exceptions: 1) sampling and analysis of gaseous effluents showed a marked increase between 1970 and 1980 with a corresponding increase in the sampling of gases as compared to the sampling of particulates, and 2) there was a marked decrease in the reported abilities of the contractors to perform ground deposition and dispersion calculations for airborne effluents.

Liquid effluent monitoring showed an overall improvement between 1970 and 1980; more sites seemed to provide continuous monitoring of liquid effluents and the systems were reported to function during DBAs. There was a greater emphasis on intermittent monitoring of environmental dose rates in 1980, but a lower percentage of respondents reported that health physics approval was required for system deactivation.

Finally, although emergency communications systems remained essentially the same (except for an increased use of the "page-boy" call system), emergency communication channels to the local police, local government, and the public news media showed a decline from 1970 to 1980.

PART THREE

THE 1980 EMERGENCY PREPAREDNESS SURVEY

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PART THREE

THE 1980 EMERGENCY PREPAREDNESS SURVEY

INTRODUCTION

The 1980 emergency preparedness questionnaire contained 15 modules:

1. Emergency Planning Responsibilities
2. Administration of In-Plant Emergencies
3. Offsite Transportation Accidents
4. Onsite Radioactive Material Shipments
5. Medical Treatment Arrangements
6. Liquid Effluent Discharge Monitoring
7. Plant Exhaust Air-Monitoring Instrumentation
8. Monitoring of Radioactive Particulates and Gases in the Environment
9. Monitoring Radiation Dose Levels in the Environment
10. Monitoring of Contamination Levels in the Environment
11. Meteorology Station Instrumentation
12. Communication Arrangements
13. Quality Assurance
14. Quality Control.

The 15th module, security, included questions about: training of security personnel, security equipment and performance testing, and agreements for assistance from city, state, and federal agencies. However, since no significant trends were observed from the responses to the security questions, no data was reported for that module.

The modular format was chosen to permit personnel with expertise in each subject area to review and to respond to individual modules separately. The majority of the questions provided blocks to check "yes," "no," "not applicable," or "no response." Other questions included checklists, and a few were

fill-in-the-blank and essay questions. The questionnaire was sent to DOE contractors through their respective field offices. A total of 30 responses were received from these seven field offices: Albuquerque, Chicago, Idaho, Nevada, Oak Ridge, Richland, and San Francisco.

Before discussing the results of this survey, the analysis methodology and the limitations on questionnaire data assessment must be identified. Not all of the questions were applicable to all of the responding facilities. Therefore, complete modules, portions of modules, or specific questions were marked as "not applicable," "no response," or they were simply left unanswered. Professional judgment was used to interpret ambiguous responses. The "not applicable" and "no response" categories have been shown in the data compilation presented in Appendix B and were taken into account when calculating the percentage of "yes" responses. The number of answers in the "no response" category has been included in the total number of applicable responses in the equation below because the particular questions applied to the contractor even though the contractor chose not to respond.

$$\begin{aligned}\% \text{ "Yes" Responses} &= \frac{\sum (\text{"Yes"})}{\sum (\text{"Yes"} + \text{"No"} + \text{"No Response"})} \times 100 \\ &= \frac{\text{Total "Yes"} \times 100}{\text{Total Applicable Responses}}\end{aligned}$$

In some cases, it was necessary to consider the accident potential at a given facility in the analysis of the data. Thus, the facilities were classified using the same system used in the 1970 survey. Facilities were classed as "high," "medium," or "low" based on the potential severity of possible accidents. The hazard-potential classification was keyed to the inventory of radioactive materials at each site and not to the probability of an accident. The facilities with the largest inventories of radioactive materials, e.g., production reactors and chemical processing plants, were placed in the high-severity group. Conversely, the facilities with the smallest inventories, e.g., research reactors and gaseous diffusion plants, were placed in the low-severity group. The facilities with inventories in the middle, e.g., laboratories and weapons testing sites, were placed in the medium-severity group.

As in the 1970 study, the assignment of a facility to a particular severity group was not made according to a rigorous or rigid scheme but according to the discretion and professional opinion of the reviewers. Of the 30 respondents, 10 were assigned to the high-severity group, six to the medium-severity group, and 14 to the low-severity group. Appendix B contains a complete printout of the questionnaire and the total number of responses as well as the number of responses for facilities in the high-, medium-, and low-severity-potential classes. Each of the modules is discussed in detail in the subsequent sections of this part. The trends observed in the physical security module were not significant and are not reported here.

The reported percentages are for all facilities, independent of their severity class, unless the severity class percentages are significantly different or of special interest (Then the percentages are reported and identified by severity class.).

MODULE 1--EMERGENCY PLANNING RESPONSIBILITIES

To insure that an effective emergency plan is developed and maintained, a specific individual or individuals should be assigned the responsibility for emergency planning at each facility, and this individual(s) should be identified in the emergency plan. The amount of time spent performing this function depends on the magnitude of potential accidents at each site and the need for offsite emergency response capabilities. All of the facilities (30) were applicable respondents in this section. (Module 1 data compilation begins on page 106 in Appendix B.)

THE EMERGENCY PLANNER

The responsibility for emergency planning was assigned to an "Emergency Planning Specialist" or "Emergency Planning Manager" at 53% of the sites. The individual assigned this responsibility at the remaining sites was either the general manager, the plant manager, or the fire chief. The respondents indicated that emergency planning was the primary assignment for 63% of these individuals and 84% of those for whom it was a primary assignment spent

greater than one-half of his/her time on this task. The remainder had other tasks to perform but the largest percentage of time on any one assignment (whether it was 50% or 25%) was spent on emergency planning. The emergency planning assignment was essentially full time at 20% of the sites. The emergency planner at nearly all of the sites was responsible for preparing and updating the emergency plan, planning exercises and drills, and reviewing critiques of drills and exercises.

REVIEW OF THE PLAN

While all sites reported that emergency plans were reviewed, the individuals responsible for review and approval of emergency plans varied. The most frequently identified were the emergency planner (83%) and the plant manager (63%). At many sites, the plans were reviewed by the site manager for DOE (37%) and the operating contractor manager (47%). Others mentioned as plan reviewers included laboratory support managers, emergency review committees, audit committees, facility managers, division managers, and safety directors.

Provisions for a review and assessment of the emergency plan should be included in the plan itself. At 57% of the sites, this quality assurance function was included.

EMERGENCY RESPONSE TRAINING

Implementation of an emergency plan requires that site personnel be trained to perform their emergency response actions and duties. All of the sites, except one low-potential site and one medium-potential site, had a person who was responsible for emergency response training. That person varied from site to site and included the emergency planner, training manager, health director, shift supervisor, fire chief, division chief, or general operations manager assistant. None of the individuals spent greater than 75% of their time on the training assignment (22% of the individuals spent 50% to 75%, and 22% spent 25% to 50%). Approximately one-half of the individuals spent less than 25% of their time on emergency response training.

Each individual's emergency response duties or required response actions to an emergency situation should be delineated in the emergency plan. Specific training for these duties and actions should be documented to ensure an effective and consistent program. Only 57% of the sites had a defined training curriculum. This training program was reviewed and approved by the emergency planner (53%), the training officer (40%), the plant manager (23%), the site manager (20%), and corporate management (67%).

Direct implementation of the emergency plan through emergency exercises and drills can result in the identification of problem areas under controlled rather than accident conditions. Simulated exercises for accident scenarios were performed at 93% of the sites. These exercises occurred semi-annually at 25% of the sites and annually at 61% of the sites. The emergency plans included drills for site emergency teams and facility emergencies at nearly all of the sites. These drills were performed either annually (54%), semi-annually (11%), quarterly (14%), or bimonthly (7%).

SUPPORT FUNCTIONS

Support functions that may be needed during an emergency should be identified and agreements for assistance should be made during the emergency planning stage. Provisions for administrative, public relations, and media liaison support were made at nearly all of the sites that responded to this section of the survey. Provisions for state and federal assistance and financial and legal assistance were made at approximately 60% of the sites that responded.

SUMMARY

This module addressed various aspects of emergency planning responsibilities including: the assignment and responsibilities of an emergency planner, an emergency response trainer, and emergency plan reviewers; the performance and frequency of simulated emergency drills and participation in such drills; and provisions for emergency support functions including state and federal assistance.

The DOE contractor facilities have assigned individuals the responsibilities for the above tasks and they have performed simulated emergency drills. Improvements appear to be needed in:

- defining curriculum for emergency response training programs
- documenting quality assurance programs for evaluating emergency plans.

MODULE 2--ADMINISTRATION OF IN-PLANT EMERGENCIES

Prompt and effective response to an emergency requires procedures for planning and maintaining a state of emergency preparedness through training and retraining. This module addressed procedures that must be in place and operational to ensure an effective emergency response. There were 29 applicable respondents to most of this module. One respondent replied that most sections of this module applied to other organizations at their site. Sections left blank by this respondent were scored as "not applicable." (Module 2 data compilation begins on page 112 of Appendix B.)

PLAN IMPLEMENTATION AND NOTIFICATION PROCEDURES

Approved procedures for implementing the emergency plan for each facility or facility operation existed at all sites except one low-hazard-potential site. The implementing procedures were reviewed and approved by plant management at 82% of the sites and by corporate management at 39% of the sites. At 79% of the sites, drills included implementing procedures.

The responsibility for declaring an emergency and implementing the emergency control action was site dependent. Among those responsible for declaring the emergency were the duty officer, plant manager, general manager, shift superintendent or supervisor, DOE manager, or several or all of these individuals. The actual implementation of the emergency plan was the responsibility of the same people in addition to the emergency planning coordinator. Agreements for assistance from local support agencies, such as the city police and fire department, existed at all sites. At 69% of the sites, these agencies were notified when offsite consequences were either detected or anticipated. At most sites, state and local agencies were notified by the DOE site manager

(23 sites). At some sites, this responsibility was handled by the emergency director, DOE headquarters, the responsible contractor, the public communication coordinator, or the state emergency service.

Approved emergency plans for each of the counties that might be affected by a release of radioactivity existed at only 50% (14 out of 28) of the sites (8 out of 10 high potential). The county was responsible for evaluating and initiating protective actions in 52% of these plans (60% for high potential), but only 35% of the respondents indicated that the responsible county officers had the training and background necessary to make these judgments.

State agencies, such as the Department of Emergency Service, Civil Defense, Department of Public Health, Director Service, and Public Safety, assumed the responsibility for offsite control of the emergency at 54% of the sites.

EMERGENCY ORGANIZATION

At 97% of the applicable sites, there was a predefined emergency organization for each onsite operating plant. At all responding sites, the plant emergency organization provided and defined the responsibilities for obtaining emergency support services. At most sites, these services included fire fighting (97%), bomb squad (90%), security force back-up (97%), transportation buses (80%), and heavy equipment (83%). Plant emergency organizations included onsite support for electrical and mechanical maintenance, technical assistance, health physics, industrial safety and hygiene, medical support, and nuclear safety and security at about 95% of the sites, and 57% included a bomb squad (100% at high potential).

The majority of the respondents (87%) were slightly satisfied or better that they had the needed information readily available to permit prompt action to control emergencies that could arise. A manual on evacuation plans was available at 90% of the sites. In most of the applicable cases, the manual included evacuation routes (89%), a current emergency communication call list (93%), assembly points for personnel (93%), and personnel radiation surveys (86%). Sixty-seven percent of the respondents indicated that vehicles and drivers were available at all times for evacuation purposes (100% for high-potential sites).

TRAINING

Twenty-five sites (83%) reported that they had adequate training to manage emergency situations. Table 3.1 lists the subjects covered in emergency training and the percentage of contractor sites that provided instruction in these areas. Ten applicable high-hazard-potential respondents are represented in the percentages in Table 3.1.

All sites, except one low-potential site, thought that their emergency plan was adequate to provide a workable framework for effective staff emergency response. Most respondents felt that drills prepared them to manage actual plant emergencies. All of the high- and medium-hazard-potential sites and about one-half of the low-potential sites indicated that support for training was available from local DOE staff.

SUMMARY

In this section, the aspects of the administration of an emergency that were discussed included implementing procedures, responsibility for declaring the emergency and controlling the response, notification of and assistance from local support groups, evacuation plans, and elements of the training program.

In general, DOE facilities had procedures for implementing emergency plans, agreements with local support groups and services, a predefined emergency organization, and manuals for evacuation. However, the following improvements may be needed:

- assurance that approved emergency plans are in place for counties that may be affected by a release
- training of county officials responsible for evaluating and initiating protective actions
- training in accident classifications, evacuation routes, reassembly points, personnel accountability procedures, contents and location of emergency kits, and response to emergency signals.

TABLE 3.1. Topics Covered in Emergency Training

<u>Topic</u>	<u>Percentage (N=30)</u>
DOE accident-reporting requirements	80
Notification requirements--federal, state, local	53
Accident classification	70
Conditions requiring evacuation	87
Evacuation plans and routes	87
Personnel accountability	83
Reassembly points	77
Survey and decontamination requirements	77
Contents and location of emergency kits	67
Procedures for transporting con- taminated patients to medical facilities	73
Evaluation of hazards to the public due to release of radioactive material to the atmosphere	57
Procedures to initiate onsite pro- tective actions	87
Procedures to initiate protective actions for public in plume pathway	50
Re-entry criteria	73
Recovery plans	67
Specialty teams that are available	83
How to respond to emergency signals	
management	97
emergency response personnel	93
all other personnel	87

MODULE 3--OFFSITE TRANSPORTATION ACCIDENTS

Effective response to offsite transportation accidents requires proper planning, adequate training, and complete coordination with federal, state, and local agencies. There were 22 applicable responses to this module. Ten of the facilities (45%) had experienced offsite transportation accidents involving shipments of radioactive material to or from their facility. Two (9%) reported onsite transportation accidents. (Module 3 data compilation begins on page 128 of Appendix B.)(a)

PLANS, PROCEDURES, AND TRAINING

Over 90% of the applicable respondents indicated that they had a plan to render assistance in the event of an offsite transportation accident involving radioactive or hazardous materials originating from their facilities. This plan included an emergency officer to coordinate the response and a team of appropriately trained individuals. Twenty-five percent of the sites had established a financial plan to provide funds to handle an offsite shipping accident.

In order to ensure timely notification of the proper government agencies, it is important that procedures, including current call lists, be in place and that other agencies have a clear understanding of their responsibilities. Ninety-five percent of the respondents had procedures to notify DOE in the event of an offsite transportation accident (one low-potential site did not). Only 14% and 35% of the sites had procedures in place to notify the NRC and the EPA, respectively. Forty-eight percent of the sites had procedures to notify the Department of Transportation (DOT); the Code of Federal Regulations (49 CFR 171.15) requires that DOT be notified in the event of a transportation accident involving radioactive or hazardous materials. State and local agencies to be notified included the state police (59%), governor's office (32%), designated state emergency operations office (50%), county sheriff (50%), and local emergency operations office (59%). Only 41% of the

(a) The eight contractors who answered "not applicable" indicated that either another contractor or DOE handled offsite transportation accidents.

respondents provided emergency instructions to law enforcement agencies in their area and only 27% provided emergency training. The above information appears to indicate that most sites would rely primarily on their own emergency response capabilities. The level of preparation for notification of offsite agencies may or may not be adequate, depending on local circumstances and the role that DOE plays in the notification of other agencies.

Seventeen of the 22 respondents (77%) had responded to a transportation accident, and all but one of the 17 (94%) critiqued their response in order to evaluate and improve their capabilities. Only 27% of the facilities had conducted drills to evaluate the effectiveness of their response.

CLASSIFICATION SYSTEM

An emergency classification scheme is useful in assessing the severity and potential consequences of transportation accidents, but only 18% of the respondents indicated that they had such a system. Overall, 82% of the respondents would favor the establishment of a uniform emergency classification system, while only 60% of the high-potential facilities favored such a system.

SUMMARY

This module addressed aspects of emergency planning that apply to offsite transportation accidents, including notification procedures, emergency training to law enforcement agencies, emergency drills, and an emergency classification system. The majority of DOE sites had a plan to assist in the management of an offsite transportation accident; one-quarter of the sites had established funds for this assistance.

Nearly all of the respondents notified DOE in the event of an offsite transportation accident. It is difficult to assess the adequacy of notification to agencies other than DOE since DOE may have been in charge of these notifications. It is also difficult to assess the apparent inadequacy of

training for law enforcement officers because DOE may be responsible for that training. Other areas, however, that appear to require an evaluation include:

- a need to conduct drills covering areas such as initial notification, use of radiation detection instruments, decontamination procedures, and recovery operations
- a need to establish a uniform emergency classification scheme for transportation accidents.

MODULE 4--ON-SITE RADIOACTIVE MATERIAL SHIPMENTS

Onsite shipments of radioactive materials represent a high potential for accidents at DOE contractor facilities. Adequate preparation for accidents involving onsite radioactive material shipments requires proper training of involved personnel. Twenty-eight of the sites ship radioactive materials onsite and were applicable respondents to this module. Twenty-five of these sites are satisfied with their onsite radioactive shipment procedures.

(Module 4 data compilation begins on page 133 in Appendix B.)

PERSONNEL AND INSTRUMENT AVAILABILITY

At 50% of the sites, radiation monitors were required to accompany on-plant shipments of radioactive materials only under certain circumstances. For example, in some cases the requirement was based on the dose rate at the surface of the package, while at others it was based on the type of shipment (i.e., weapons convoy, special nuclear material) or the risk involved in the shipment. At 11 sites (39%) monitors never accompanied shipments, and at 3 sites (11%) they always accompanied shipments.

INSTRUMENT AVAILABILITY AND OPERATION

At 15 of the applicable sites (54%), radiation-monitoring instruments were available on shipment vehicles. The transport crew was trained in the proper operation of monitoring instruments and interpretation of results at 57% of the sites. Transport crews were retrained in the operation and interpretation of the monitoring instruments at 38% of the sites. Retraining in

these skills occurred quarterly at two sites, semi-annually at one, annually at five, and biennially or less at two.

REPORTING OF ACCIDENTS

Procedures for reporting on-plant shipment accidents vary among DOE facilities. They may be reported to an emergency response team, security, various levels of plant management, the driver's supervisor, DOE, radiation monitoring, hazards control, or a warning center.

SUMMARY

All of the responding sites had procedures for reporting onsite radioactive material shipment accidents. Although approximately one-half of the facilities did not have radiation-monitoring instruments and crews trained in their use aboard the shipment vehicle, adequate response would be likely during an accident because of the availability of trained facility radiation monitors.

MODULE 5--MEDICAL TREATMENT ARRANGEMENTS

Prior arrangements with medical facilities and staff responsible for handling potentially radioactive patients are an essential aspect of emergency preparedness. Such arrangements should include proper training of medical personnel, availability of radiation detection instruments, protective clothing and dosimetry, and a formal agreement for medical assistance. This module had 26 applicable respondents (this module was "not applicable" to the other four facilities), and all 26 had access to medical treatment facilities other than industrial first aid stations. (Module 5 data compilation begins on page 136 in Appendix B.)

OFFSITE MEDICAL ASSISTANCE

Ninety-two percent of the respondents had made arrangements for medical assistance from and had formal agreements with outside medical facilities, who agreed to accept and treat all contaminated patients from the responding

sites. Twenty-five sites (96%) had radio communication systems that permitted them to request medical assistance from the field.

Equipment for radiation detection and monitoring was available at all of the offsite medical facilities. Health physics support was available from the plant at 96% of the applicable facilities. Dosimetry programs, available on or near the site, included chest counting (77%), whole body counting (85%), wound counting (92%), and bioassay of blood, feces, and urine (96%).

TRAINING

Exercises and drills should be conducted with the medical staff to ensure prompt notification of the medical facility, a smooth transfer of the patient, and adequate performance of safety and decontamination procedures. Four of the respondents (one high potential, one medium potential, and two low potential) did not feel that the medical support staff was sufficiently knowledgeable in radiation protection and three of the sites did not answer this question. While only 73% of the sites judged the offsite medical support personnel to be qualified in the area of radiation protection, only one-half of the sites conducted emergency training sessions.

SUMMARY

Based on the responses to this module, the DOE facilities that were surveyed had adequate arrangements for medical assistance in the treatment of contaminated patients, although a few of the sites did not have formal agreements with a medical facility. These arrangements included the availability of radio communications to the medical facility and radiation-measuring instruments at the medical facility. The only area that should be evaluated is the training of medical support personnel, because 27% of the sites either did not believe or did not want to make the judgment that the medical support staff was sufficiently knowledgeable in radiation protection.

MODULE 6--LIQUID EFFLUENT DISCHARGE MONITORING

Some combination of sampling and analysis and/or continuous monitoring of the liquid effluents discharged from nuclear facilities is required to ensure compliance with federal and state regulations concerning the concentration of radionuclides released to the environment. Monitoring and/or sampling and analysis data are also essential to characterize a source term in the event of a release. The frequency, method, and complexity of the program for monitoring liquid effluents will be dependent upon the type of facility and the associated potential for release of radioactive material to the environment. There were 23 applicable respondents to this module (four facilities answered "not applicable" and three gave no response). (Module 6 data compilation begins on page 140 in Appendix B.)

FREQUENCY

Continuous, real-time monitoring of liquid effluents provides an enhanced capability for early warning of unexpected releases; however, sampling and analysis frequently provides a lower minimum detectable level than continuous monitoring systems. Eleven of the 26 applicable respondents used both continuous detection and sampling and analysis of their liquid effluent streams (five out of nine high-potential sites). The remainder used only sampling and analysis.

CONTINUOUS DETECTION AND MONITORING

Hard-copy effluent monitor data is essential to characterize source terms. Effluent monitor response was recorded at 69% of the applicable sites (four out of five high-potential sites), and the same respondents indicated that their effluent monitors were connected to annunciators located in a manned location. Fifty-four percent of the respondents indicated that the flow through the monitor was proportional to the effluent flow. The average daily discharge rate ranged from 8×10^3 gal/day to 4.3×10^8 gal/day. Approximately one-fifth of the sites monitored the total discharge flow, but none of the high-potential sites did. Most of the high-potential sites

monitored a sample, ranging from 32 liters to 0.5 liters, of the total discharge flow. Two respondents misinterpreted the question and reported the liquid effluent flow rate. The minimum detection level of the monitoring systems ranged from 2×10^{-7} $\mu\text{Ci/ml}$ (based on ^{137}Cs) to 2.5×10^1 $\mu\text{Ci/ml}$ (basis not specified). Seven of the minimum detection levels listed were greater than the maximum permissible concentration (MPC) for unidentified radionuclides (3×10^{-6} $\mu\text{Ci/ml}$)(a) as specified in DOE Order 5480.1, Chapter XI.

SAMPLING AND ANALYSIS OF LIQUID EFFLUENTS

Eighty-seven percent of the respondents performed specific radionuclide analysis, but 63% did not correct the measurements for radioactive decay (the nuclide half-lives were not specified). A wide variety of analysis techniques were used (see Appendix B, page 143). The elapsed time between sampling and analysis ranged from 1 h to 720 h. For sampling and analysis data to be useful for an emergency response, the data must be available shortly after sampling. Three out of eight high-potential sites, however, indicated that they required over 24 h to analyze effluent samples.

The estimated liquid effluent concentration that would result from a design basis accident (DBA) ranged from 10^{-6} $\mu\text{Ci/ml}$ to 2.8×10^5 $\mu\text{Ci/ml}$. One high-potential and one low-potential site reported that they would be unable to measure their DBA concentrations with current instrumentation. An important criterion for emergency preparedness instrumentation is the capability of measuring the entire range of expected concentrations.

CALIBRATION

Instrument calibration and performance testing are essential for emergency preparedness instrumentation; they ensure the accuracy and reliability of the data obtained during emergencies. The data for this section and the following section of this module (system reliability) was difficult to analyze

(a) This limit applies for unidentified radionuclides in a restricted area if it is known that ^{226}Ra and ^{228}Ra are not present. Other limits apply if the radionuclide composition of the effluent is known.

because of a general confusion over the term "monitoring" as opposed to "sampling and analysis." Previous sections of the module distinguished between the two methods, but the subsequent sections used the term "monitoring" exclusively. So, some of the contractors who only performed sampling and analysis did not answer these sections. The analysis percentages, therefore, are based on the total number of applicable respondents to each individual question.

The majority of respondents reported that their effluent-monitoring systems were calibrated regularly. One high-potential site, however, did not calibrate its effluent-monitoring system at all. All of the respondents performed routine operational checks on a regular basis. One high-potential site indicated that their effluent-monitoring sensor was located so that it could not effectively sense radioactivity in the effluent stream (because of a steel wall barrier), and that the system for measuring the sample flow rate was never cleaned and calibrated.

SYSTEM RELIABILITY

In addition to proper calibration and performance testing, emergency preparedness instrumentation must be properly located, maintained, and protected so that it will provide consistent and reliable information. All of the respondents indicated that their DBA would not affect the performance of their effluent-monitoring system except for one high-potential site, which indicated that an earthquake would affect the system. Fifty-nine percent of the respondents (four out of six high-potential sites) had annunciators in manned locations that would alarm if a set point was exceeded. Fifty-nine percent of the respondents (five out of seven high-potential sites) indicated that their liquid effluent monitors would function if grid power failed. Automatic back-up power (as opposed to manual back-up) was provided at 40% of the responding sites.

Fifty-five percent of the sites (57% of high-potential sites) did have a quality assurance (QA) program to cover liquid effluent monitoring and only 56% of the liquid-effluent-monitoring systems were on a preventative maintenance program.

MONITORING LIQUIDS DISCHARGED TO THE ENVIRONMENT

Monitoring of liquid effluents discharged to the environment is essential to evaluate potential exposure of the general population to radioactive materials. Liquid effluents were monitored at site boundaries at frequencies ranging from continuously to quarterly. Twelve of the facilities (50%) indicated that they released liquid effluents to points beyond their site boundaries. Approximately one-half of these sites, including all of the high-level respondents, sampled downstream potable water supplies in the event of an elevated monitor or sampler response. Sixty-seven percent of the sites had established concentration levels that, if exceeded, would result in the temporary suspension of the use of the water. Only one of the sites (9%) indicated that health physics approval was required to deactivate the monitoring system, and 43% reported assurance that the monitoring system would not be affected by adverse environmental conditions during a DBA.

OTHER ISSUES

Approximately one-third of the respondents indicated that they used the services of an outside company or agency for their environmental monitoring program. Only one-half of the respondents indicated that they had a QA plan for their environs liquid-effluent-monitoring system. Six sites indicated that they had plans to upgrade their environs liquid-effluent-monitoring instrumentation. These plans included improving detection limits, continual proportional sampling of all streams, and investigating on-line tritium detection.

SUMMARY

This module addressed aspects of continuous detection and monitoring techniques and sampling and analysis techniques for liquid effluents. In characterizing continuous detection and monitoring, inquiries were made about recording of data, connection to annunciators, proportionality of monitor flow, monitoring of total discharge, and minimum detection levels. Sampling and analysis techniques were characterized with questions about radionuclide

analysis, decay corrections, analysis time, and measurement of DBA concentrations. All of the topics above seemed to be adequately covered with the following exceptions:

- radionuclide analysis and resulting activities were not corrected for radioactive decay (this is not an item of concern if all nuclides are long lived)
- an excessive amount of time elapsed between sampling and analysis at some sites
- some facilities use instrumentation incapable of measuring DBA concentrations.

The calibration and reliability of the liquid-effluent-monitoring systems were also addressed in this module. Those items that may need to be evaluated are:

- only about one-half of the sites had a quality assurance program and a preventative maintenance program for effluent monitors.

Monitoring of the liquid effluents discharged to the environment was another topic addressed in this module, and questions were included about these areas: sampling of downstream water supplies, establishing standard concentration limits, requiring health physics approval for system deactivation, assessing the DBA's effect on the system, and establishing QA plans. All of the above topics may require investigation because of the following findings:

- only one-half of the applicable respondents sampled the downstream potable water supply after an elevated response of the monitor
- almost one-third of the sites had not established liquid effluent concentration limits above which water would be declared not potable
- at nearly 90% of the sites, deactivation of the environmental-monitoring system did not require health physics approval
- at about 60% of the sites, the system would be affected by the DBA
- one-half of the sites had no QA plans.

MODULE 7--PLANT EXHAUST AIR-MONITORING INSTRUMENTATION

Exhaust air monitoring is essential to source term characterization in the event of an accidental release of radioactive materials. Airborne effluents can be characterized either through continuous detection and monitoring or through sampling and analysis. There were 29 applicable respondents to most of this module. Four facilities answered "not applicable" and one facility provided separate responses for four facilities at their site. (Module 7 data compilation begins on page 155 in Appendix B.)

SAMPLING METHODS

Fifty-four percent of the applicable respondents indicated that radio-nuclides might be released through an unfiltered exhaust under accident conditions, but the levels of releases were not specified. Eighty-two percent (23 sites) of the respondents monitored gaseous and particulate effluents by both continuous monitoring and sampling and analysis. Two medium-potential and one low-potential site performed continuous monitoring only and one medium-potential and one low-potential site performed sampling and analysis only.

CONTINUOUS DETECTION AND MONITORING

Continuous detection and monitoring of plant exhaust air provides enhanced early warning capability in the event of an airborne release. Continuous monitoring also provides a means of characterizing changes in air concentrations with time.

A wide range of detection systems were used for gaseous effluent monitoring at DOE facilities; the type of system used was dependent upon the radio-nuclide(s) of interest (see Appendix B). The same generalization applied to particulate monitoring.

Ninety-two percent of the respondents were able to relate measured effluent concentration to a Ci/sec source term. Forty-eight percent of the sites predicted that the response of their airborne-effluent-monitoring system could be invalidated by foreseeable emergency conditions.

SAMPLING AND ANALYSIS

Sampling and analysis of airborne effluents generally provides greater sensitivity than continuous monitoring, but it lacks the advantage of providing real-time data on airborne releases. Sixty-three percent of the respondents indicated that sample air flow at their facilities was proportional to the discharge flow rate. The discharges were sampled for gases and particulates at 81% and 89% of the sites, respectively. Only two out of 27 applicable respondents, however, indicated that particle size determinations were done on a regular basis. Forty-two percent of the respondents augmented their routine sampling program with spot sampling. Twenty-seven percent of the respondents analyzed samples for gross radioactivity, and only 54% computed the activity back to an initial concentration. Sampling methods varied and included the use of filter paper, charcoal, and solutions. Eighty-five percent of the sites indicated that radionuclide concentrations in the air could be converted to ground depositions at various distances from the facility.

ACCURACY AND RELIABILITY

In order for airborne-effluent-monitoring instrumentation to be useful during an emergency, the data it produces must be accurate and reliable. Eighty-one percent of the respondents indicated that their systems were equipped with a back-up power supply, and 95% of these indicated that the back-up supply was automatically activated. Eighty-nine percent of the sites reported that their sampling system provided an accurate and reliable measurement. Approximately one-half of the respondents indicated that a DBA could subject the monitoring system to environmental conditions that could affect its performance. Twenty percent of the sites reported that DBA radiation levels would cause the monitoring location to be inaccessible. All but one site (a medium potential) had made plans to relocate the readouts to areas that could be occupied.

Seventy-six percent of the sites had their effluent-air-monitoring systems on a preventative maintenance schedule, with maintenance frequencies ranging from monthly to annually. Fifty-five percent of the respondents

performed daily operational checks of their systems, and 70% of the sites had their systems on a routine calibration schedule. Health physics approval for deactivation of the monitoring system was required at 81% of the sites.

SUMMARY

The majority of DOE facilities used both continuous monitoring and sampling and analysis of plant exhaust. The topics addressed under continuous monitoring included types of monitors, ability to relate measured concentration to a source term, and effect of the DBA on the system operation. Sampling and analysis techniques that were discussed included proportionality of sample flow rate, particle size determination, radionuclide identification, decay corrections, and determination of ground depositions. The accuracy and reliability of the plant-exhaust-monitoring system was also discussed in this module.

There appeared to be no difficulty in relating the effluent concentrations to a source term. Routine calibration procedures existed at some, but not all, facilities. Other areas of concern at some sites include:

- the response of the airborne-monitoring system could be invalidated by foreseeable emergency conditions
- measured activity was not corrected for radioactive decay
- the system accuracy and reliability was not assured
- the DBA could affect the system operation due to environmental conditions or could cause the monitoring location to be inaccessible
- health physics approval was not required for system deactivation.

MODULE 8--MONITORING OF RADIOACTIVE PARTICULATES AND GASES IN THE ENVIRONMENT

Release of airborne radioactive particulates and gases to the environment represents the most significant exposure pathway for the general public in the vicinity of a nuclear facility. Therefore, accurate and reliable measurements

of particulates and radioactive gases in the environment are extremely important in emergency situations. There were 24 applicable responses to this module (six facilities responded "not applicable"). (Module 8 data compilation begins on page 168 in Appendix B.)

FREQUENCY

Forty-two percent of the applicable respondents, including four out of seven of the high-potential respondents, used both continuous monitoring and sampling and analysis to evaluate levels of airborne radioactivity in the environment near their facilities. The remaining facilities (58%) used only the sampling and analysis method.

CONTINUOUS DETECTION AND MONITORING

Continuous detection and monitoring provides early warning capabilities in the event of a release of radioactive materials. Seventy percent of the respondents indicated that they monitored radioactive gases in the environment continuously, while 80% monitored particulates continuously. Only one-half of the high-potential sites monitored particulates continuously. The majority of the respondents filtered the sample to discriminate between gases and particulates. The range of responses for gases varied from $2 \times 10^{-11} \mu\text{Ci/cc}$ (based on tritium) to $1 \times 10^6 \mu\text{Ci/cc}$ (basis not specified). The range of responses for particulates varied from $4 \times 10^{-16} \mu\text{Ci/cc}$ (α) to $1 \times 10^6 \mu\text{Ci/cc}$.

SAMPLING AND ANALYSIS

Sixty-three percent of the contractors sampled for gases and 96% sampled for particulates. Only 54% of the contractors reported the ability to perform particle size analysis, although this is probably not of concern from an emergency preparedness standpoint. Fifty-eight percent of the respondents had the capability to convert concentration data to ground deposition values. A wide variety of radionuclides, including tritium, noble gases, fission gases, uranium, and transuranics, were listed as being associated with normal releases and releases under accident conditions.

Only 8% of the respondents (29% of the high potential) had their environmental-monitoring systems connected to automatic annunciators to signal upscale responses. None of the respondents had their environmental-monitoring systems connected to an annunciator that would signal a system malfunction.

The time lapse between sampling and analysis ranged from 1 hour or less to more than 120 hours. Four of the high-potential respondents indicated that they required 72 hours or more to analyze samples. Analysis times exceeding a few hours are probably unacceptable for emergency response purposes. Only 25% of all respondents and only one of the high-potential respondents were capable of using other types of data (such as extrapolation of source term data) to estimate noble gas concentrations.

CALIBRATION AND RELIABILITY

All but one of the respondents indicated that their environmental-monitoring system was functionally tested at some regular frequency. Four of the respondents (one high, two medium, and one low potential) did not calibrate their electronic measuring systems, and three did not calibrate their air-flow-measuring systems (two high, one medium potential). Only 29% of the sites (14% of the high potential) were assured that their system would function under DBA environmental conditions, and only 33% (57% of the high potential) had emergency back-up power.

SUMMARY

This module discussed the monitoring and sampling of particulates and gases in the environment, and the calibration and reliability of the measurement systems. The responses to all of the topics addressed in this discussion indicated a need for improvement. The following are areas of concern:

- inability to convert concentration data to ground deposition values
- lack of annunciators to indicate upscale responses or system malfunctions
- long time lapse between sample collection and analysis
- calibration of the measuring system was not performed at some sites
- emergency back-up power at only one-third of the sites.

MODULE 9--MONITORING RADIATION DOSE LEVELS IN THE ENVIRONMENT

Dose levels in the environment must be monitored to determine the impact of the nuclear industry on the background radiation levels. In the case of an emergency at a specific facility, dose levels can be used to assess the need for evacuation. Of the 23 applicable respondents to this module, 21 monitored environmental dose rates at frequencies ranging from continuously to annually. The two sites which did not monitor were low-potential sites. It is assumed that the majority of dose rate instruments were not in a fixed location but were taken into the field at regular frequencies. (Module 9 data compilation begins on page 179 in Appendix B.)

METHOD OF MONITORING

Thermoluminescence dosimeters (TLDs) were used by 83% of the sites to measure dose rates in the environment. In addition, one or more of the following instruments were used by some of the facilities: GM detectors (13%), ionization chambers (13%), scintillation crystals (13%), and proportional chambers (9%). The gamma contribution to the dose was measured by 83% of the sites (71% of the high-potential sites) and the beta contribution by only 35% of the sites (29% of the high potential).

CALIBRATION AND RELIABILITY

The dose-rate-monitoring systems at 17 sites were calibrated at frequencies ranging from weekly to annually. At two sites (one low and one medium potential) they were not calibrated at all. According to ANSI N323-1978, these systems should be calibrated at least annually.

The monitoring system was connected to a process alarm at 17% of the sites, and emergency power was available at 22% of the sites. Health physics approval for system deactivation was required at only 43% of the sites.

SUMMARY

Methods of monitoring dose levels in the environment and the calibration and reliability of the measurement systems were discussed in this module. All of these topics may require review based on the following responses from some sites:

- inability to distinguish between the beta and gamma contribution to dose
- calibration of measuring systems was not performed
- provisions for back-up emergency power were minimal
- health physics approval for system deactivation was not required.

MODULE 10--MONITORING OF CONTAMINATION LEVELS IN THE ENVIRONMENT

Knowledge of the contamination levels in the environment, before and after an accidental effluent release, provides the information required to evaluate and respond to an emergency situation. This response may include protective actions that would limit the food and water intake by the general public. The number of applicable respondents varied for each question. (Module 10 data compilation begins on page 184 in Appendix B.)

METHOD OF MONITORING

Deposited contamination was generally determined using either portable survey instruments or media sampling followed by radiochemical analysis in the laboratory. Direct measurements were made using μ R meters, GM detectors, scintillation detectors, Ge(Li) spectroscopy, and high pressure ion chambers.

A variety of media were collected for analysis. The majority of sites collected soil (91%), vegetation (91%), surface water (78%), and potable water (74%) samples. Milk was collected at 43% of the sites. Other media samples included waterway sediments, wildlife specimens, water vapor, air, well and spring water, subsurface water, animal feces, and crops. Some of the facilities made no field measurements on the media samples that were collected. Although field measurements may not be necessary for routine environmental surveillance, they should be done in an emergency situation.

ANALYSIS

A number of radionuclides were identified in the laboratory analyses of environmental samples. Those most frequently mentioned were plutonium-238, 239, uranium-235,238, cesium-137, and strontium-90. Other radionuclides that were analyzed included tritium, iodine-131, technetium-99, cesium-144, ruthenium-103,104, cobalt-60, americium-241, iron-59, manganese-54, and neptunium-237.

Thirty-nine percent of the sites (25% of the high-potential sites) correct for radioactive decay between sample collection and sample analysis time. This correction should be made for short-lived radionuclides to accurately determine contamination levels in the environment during specific time periods.

ACCURACY AND RELIABILITY

Only about half of the sites had assurance that their monitoring systems would function under adverse environmental conditions. Since protective actions taken during an emergency frequently depend on field results, this assurance is critical. One high- and one low-potential site did not calibrate their monitoring systems, but the remaining sites calibrated them daily (20%), weekly (15%), monthly (10%), quarterly (15%), semi-annually (15%), or annually (5%). According to ANSI N323-1978, Radiation Protection Instrumentation Test and Calibration, the monitoring systems should be calibrated at least annually.

Among the seven sites that reported the DBA anticipated radiation levels at the monitor readout location, two sites reported that these levels would pose a significant hazard to personnel at those locations. However, provisions were being made to relocate these readouts to locations that could be occupied.

AERIAL MONITORING

Thirty-two percent of the applicable respondents (nine out of 28) reported that aerial survey instrumentation was available at their sites (two

out of eight high-potential sites). Five sites reported that an emergency aerial survey could be initiated in six hours or less; but two sites required 24 hours, which seems excessive since the aerial measuring system of DOE is expected to be available within 12 hours or less after the start of a nuclear incident (FEMA-REP-2, 1980). Only one site indicated that they could relate aerial survey results directly to ground concentration levels. At other sites this was either not done, or assumed to be done by others.

SUMMARY

This module addressed contamination level monitoring in the environment. Specific topics that were discussed included: types of media samples collected, the laboratory analysis of these samples, decay corrections, accuracy and reliability considerations, and aerial monitoring capabilities.

A wide variety of samples were collected by the sites and they appeared to have adequate isotope identification capabilities. Those sites that reported that the DBA would create high radiation levels at the readout locations also stated that the readouts were being relocated. Although it is difficult to assess the need for aerial monitoring, this need should be reviewed for the high-potential sites since only 25% of those had this capability. Areas of concern include:

- no correction for radioactive decay between sample collection and analysis time at one-half of the sites
- some of the sites did not calibrate the monitoring system
- there was an excessive amount of time required to initiate emergency aerial survey at two sites
- aerial survey results could not be related to ground concentration levels in some cases.

MODULE 11--METEOROLOGY STATION INSTRUMENTATION

Appropriate meteorological data is required to track a gaseous effluent release and determine dose levels to the population and contamination levels

in the environment. However, the need for meteorological data is dependent on the nature of the work performed and the potential for accidents at the facility. Fifteen of the contractor facilities that were surveyed were applicable respondents and had meteorological monitoring programs. Four out of 10 high-hazard-potential facilities had meteorological programs. One other high-potential facility reported that another contractor was responsible for their program. (Module 11 data compilation begins on page 195 in Appendix B.)

METHOD OF MONITORING

Horizontal wind direction and horizontal wind speed were measured by all of the responding sites, but only 20% of the sites measured vertical wind direction and only 27% measured vertical wind speed (two out of four high-potential sites in both cases).

Averaged measurements lessen the chance of an errant measurement being used in an emergency situation and should be a part of every meteorological program. Eighty percent of the applicable sites, including all high-potential sites, used averaged measurements.

An atmospheric stability class, which describes plume dispersion characteristics, can be determined by calculating the change in air temperature (ΔT) between two different elevations. Nine sites measured air temperature at more than one elevation and could therefore calculate ΔT . Two sites reported that the atmospheric stability class was determined by measuring the variation in wind direction and speed. The remaining four sites should develop a method of determining the atmospheric stability class.

Real-time computer systems were used to perform meteorological calculations at 40% of the sites (75% of the high-potential sites). Several sites reported that a real-time computer system was under development. All sites with real-time computer systems, except one low-potential site, could compute cloud dispersion and ground deposition.

Three of the 15 sites were capable of doing plume tracking with helicopters or airplanes, but none of the high-potential sites reported this capability. Eighty-seven percent of the sites reported a method to be used for

predicting plume travel. Three of the four high-potential sites used the Atmospheric Release Advisory Capability (ARAC) system. Other methods included hand calculations, Gaussian plume models, nomograms, and a transport and diffusion computer model.

ANALYSES

The analyses of meteorological data was computerized at eighty percent of the facilities and at all high-potential sites. Forty percent of the sites (one out of four high potential) reported that their readouts were located in a constantly manned location. The remaining sites should ensure that readout locations are manned during an emergency and that meteorological data is forwarded to appropriate personnel (e.g., dose assessment personnel or individuals involved in protective action decision making).

ACCURACY AND RELIABILITY

Eleven of the 15 sites with meteorological systems reported that they calibrate their systems. Five sites reported performing quarterly calibrations, two sites reported annual calibrations, and the others reported either infrequent or random calibration frequencies.

Meteorological stations should be located in areas and at heights that are representative of potential release points. Seventy-three percent of the sites (all of the high-potential sites) reported that stations were located in positions that would ensure optimum accuracy and reliability.

Sixty-seven percent of the sites had a back-up power supply (50% of the high potential). All of the sites should have had either a back-up power supply, an independent back-up meteorological system, or provisions for getting meteorological data from a nearby national weather service office or similar location.

SUMMARY

The characterization of the meteorological systems included the measurement of wind speed, wind direction, and atmospheric stability class; and the

use of computer analysis, plume tracking capabilities, meteorological station and readout locations, and accuracy and reliability considerations. One-half of the contractors had meteorological systems in 1980 and more anticipated the installation of equipment.

The majority of meteorological programs included instruments that accurately measured horizontal wind direction and wind speed. Most responding sites could determine the atmospheric stability class and used computers for data analysis. The majority of sites calibrated their systems and used some method to predict plume travel. However, the need for meteorological programs and their content should be reviewed to determine if additional guidance should be provided to DOE facilities. For example:

- not all of the high-potential sites had meteorological programs
- most sites did not measure vertical wind direction and speed
- several sites did not provide averaged meteorological measurements
- several sites did not determine the atmospheric stability class (this describes plume dispersion characteristics)
- none of the high-potential sites reported the ability to track the plume with aircraft
- optimum accuracy and reliability of the meteorological system was not assured at some sites
- back-up power supplies or back-up meteorological systems were not available at most sites.

MODULE 12--COMMUNICATION ARRANGEMENTS

Effective and reliable emergency communications networks are vital components of emergency preparedness. Emergency communication networks may consist of existing plant telephone systems for low-hazard-potential sites or dedicated radio and telephone networks for high-hazard-potential sites. In either case, the networks must be tested periodically, and the personnel responsible for emergency communications must be properly trained in their

use. There were 28 applicable respondents to this module. (The two remaining sites answered "not applicable" to this section.) (Module 12 data compilation begins on page 205 in Appendix B.)

COMMUNICATIONS EQUIPMENT

All of the respondents indicated that they possessed some combination of communications equipment that would be available in an emergency. The contractors were not asked if the communication systems were specifically dedicated to emergency response. All respondents replying to this module reported having two-way radios, "page-boy" call systems, and walkie-talkies. The number of units were divided equally among the three types of equipment. Several respondents noted that they had dedicated emergency telephone systems. The majority of respondents rely on radio communications and walkie-talkies, supplemented by telephones and runners, to report field survey results to the emergency control center.

COMMUNICATION CHANNELS

It is extremely important that communication channels be established with the appropriate authorities, support services, and news media prior to an emergency. The DOE contractor facilities had established communication channels with DOE (96%), a medical center (93%), management staff (96%), local police (82%) and fire departments (79%), public information media (61%), local government (54%), state radiological control personnel (18%), and NRC (11%). The groups that contractor facilities should make an effort to contact will vary according to local requirements. All contractors would not necessarily need to contact all groups identified. All facilities should establish communication channels with the public news media, since news reporting can have a significant effect on the public's perception of an emergency situation.

REVIEW AND UPGRADING

The communication network was periodically reviewed at 96% of the sites, and 93% held routine practices to test the system. Eighteen facilities (64%) had plans to upgrade their communication system, including plans to: install

dedicated telephone lines, install tape recorders to record calls, add new security base stations, and procure more and newer equipment.

SUMMARY

The module on communications arrangements addressed the types of communication devices; the communication channels between the contractor and local support groups, local government, and licensing agencies; and the review and proposed upgrading of communications networks. The contractor facilities had adequate quantities of communications equipment and conducted appropriate drills and reviews of the communication networks. Almost all of the sites had established communication channels with DOE and a medical facility. However, communication channels had not been established with all of the support services and authorities that may be called on for assistance during an emergency. Almost one-half of the sites had not established communication channels with the local government, and about one-third had not done so with the news media.

MODULE 13--QUALITY ASSURANCE

The term quality assurance (QA) encompasses all of the planned and systematic actions that are needed to provide adequate confidence that a structure, system, or component will perform satisfactorily. In the context of this report, quality assurance is a planned program for verifying that each part of the emergency preparedness program is done adequately and that the total program meets its purpose.

This module had 28 applicable respondents; ten high-, six medium-, and 12 low-hazard-potential sites. Two sites answered "not applicable." A documented quality assurance (QA) program that covered emergency operations existed at 39% of the sites (30% of high-potential sites). A documented QA program that covered environmental monitoring existed at 64% of the sites. (Module 13 data compilation begins on page 214 in Appendix B.)

QUALITY ASSURANCE ORGANIZATION

Eighty-six percent of the sites identified an office, an officer, or a staff that was responsible for QA (henceforth referred to as QA staff). However, only 29% of the QA staffs reviewed the site emergency plan, and only 48% reviewed the environmental surveillance program. The QA staff reviewed the emergency training program at 22% of the sites.

INSTRUMENTATION QUALITY ASSURANCE

The following instrument parameters were addressed by the procurement specifications at the following percentages of facilities: range (81%), accuracy (81%), and environmental stresses such as temperature and humidity (77%). Nine of the ten high-potential sites reported that these parameters were addressed in the specifications. Certification by the vendor that monitoring equipment had been tested and met procurement specifications was required at only 54% of the sites (70% of the high-potential sites). Acceptance testing of new instruments against the specifications was performed by 88% of the sites (75% of the high-potential sites).

DOCUMENTATION

A central repository for all QA records was maintained at 30% of the sites, and 80% of these sites maintained the records at separate locations. Of the 15 sites that responded to a question on the length of time QA records were maintained, about half maintained the records for 5 years or less, and the rest kept them for 75 years or more.

SUMMARY

The quality assurance programs for emergency preparedness at DOE sites were considered in this module. Topics included the responsibilities of the QA staff, certification and acceptance testing of instruments, and documentation of QA records. Although 86% of the sites had a QA staff, more than one-half of the sites did not have documented quality assurance programs for emergency operations. Additionally, the QA staffs did not review the emergency plan or the emergency training programs at the majority of DOE

facilities. Some of the sites did not perform acceptance testing of instruments against vendor specifications and about one-half did not ask for vendor certification of instrument performance.

MODULE 14--QUALITY CONTROL

Quality control (QC) encompasses all the quality assurance actions that are necessary to control the physical measurements of a device in accordance with predetermined requirements. All nuclear facilities should employ quality control procedures to ensure proper, uniform, and unbiased measurement results. The actions that are addressed in this section include calibration, preventative maintenance, operational checks, written procedures, sample analyses, and documentation. There were 25 applicable respondents (unless otherwise noted) to this module. The remaining five answered "not applicable." (Module 14 data compilation begins on page 219 in Appendix B.)

QUALITY CONTROL OF EFFLUENT MONITORING

Sixty-eight percent of the respondents had written procedures for calibration of air-monitoring equipment and 64% had written procedures for calibration of water-monitoring equipment. Written procedures for operation of monitoring equipment for air and water existed at 72% and 68% of the sites, respectively. The air and water effluent-monitoring equipment was on a preventative maintenance schedule at 72% of the sites. Fifty percent of the sites reported monthly maintenance frequencies for air-monitoring equipment. Twenty-eight percent reported quarterly frequencies, and the remaining 22% performed preventive maintenance no more often than semi-annually. The preventive maintenance schedules for water-monitoring systems were equally divided among monthly, quarterly, and semi-annually or longer. Operational checks on air-monitoring instruments were made by 96% of the sites and on water-monitoring instruments by 88% of the sites. Checks were conducted on each shift by approximately 15% of the facilities, daily by about 50%, and weekly by about 20%. Approximately one-half of the sites calibrated their effluent-monitoring instruments over the full range of operating conditions (normal to DBA).

QUALITY CONTROL ON SURVEY INSTRUMENTS AND DOSIMETERS

There were 26 applicable respondents to this section and 77% of those had written calibration procedures for emergency portable survey instruments (four sites answered "not applicable"). Calibrations were performed at least annually by 81% of these facilities. Fifty-seven percent of the sites had written operational procedures for emergency portable survey instruments. Survey instruments were maintained and calibrated by 79% of the facilities and the remainder had their equipment maintained and calibrated by other contractors within their field organizations. Less than one-third of the sites had their survey instruments calibrated in accordance with ANSI N323-1978,^(a) but 82% had their survey instruments calibrated using a source that was traceable to the U.S. National Bureau of Standards. For an instrument calibration to be valid, points near the end of each scale (20% and 80% of full scale) must be checked (ANSI N323-1978). One facility calibrated over only one scale of the survey instruments, and six sites checked only one point on the scale.

Preventive maintenance was performed on the equipment in the emergency kits by 80% of the sites with a frequency ranging from weekly to annually. The dates of previous and future maintenance were labeled on each instrument at 75% of the facilities.

A little over one-half of the sites (16 of 27) processed their own personnel dosimeters. Written procedures for processing were available at 75% of these sites. A majority of the facilities could routinely process the personnel dosimeters and have the results back within 14 days; however, two facilities reported that it took as long as 90 days to receive their dosimeter results. Ten sites indicated that processing could be completed in one hour under emergency conditions, but one site required 72 hours under emergency conditions, and six sites required over 24 hours.

QUALITY CONTROL ON SAMPLING

Seventy percent of the 27 applicable respondents had written procedures for collecting samples, 59% for preserving samples, 70% for packaging samples,

(a) Another 37% of the sites did not know.

and 59% for identifying samples. Sample tags attached in the field included the sample time (78% of the applicable respondents), date (89%), location (85%), description (78%), volume (70%), on/off time (air) (89%), and name of individual collecting the sample (70%). Unique identification numbers for each sample were assigned by 78% of the sites. Replicate samples of water, air, soil, and vegetation were taken by approximately one-half of the sites at frequencies ranging from daily to annually.

ANALYTICAL QUALITY CONTROL

Sixty-four percent of the facilities performing sampling (14 of 22) analyzed all their samples onsite; 14% used an offsite analytical contractor; and 23% of the facilities had both onsite and offsite analyses performed. A quality control program to check the performance of the offsite contractor existed at 50% of the applicable sites.

Most of the remaining questions in this section were answered by more facilities (20 or more sites) than the 14 that had specified onsite analysis capabilities. Apparently, even though some of the sites did not have analysis capabilities, they did have procedures for these tasks or were familiar with the offsite contractors' procedures.

All of the responding sites had written procedures for the analysis of effluent samples, 91% had written procedures for environmental sample analysis, and 73% for bioassay samples. Written analytical procedures for all nuclides that could be released in accident situations were present at 78% of the sites. Written procedures and schedules for calibration checks and for background determinations of the counting instruments were present at 87% of the sites. The results of these checks were maintained on control charts at 61% of the sites.

Eighty percent of the responding sites used standards, either directly or indirectly traceable to the U.S. National Bureau of Standards, for purposes of calibration, and 65% had written procedures that specified the actions to be taken whenever quality control checks were outside specifications. A majority of the sites analyzed blank or spiked samples at least monthly. Ninety-one percent of the plants analyzed their samples in duplicate. All sites

participated in intercomparison programs. Approximately one-quarter of the sites routinely split samples with other laboratories, usually on a quarterly basis.

COMPUTATIONAL CHECKS

Fifty-four percent of the sites had procedures for checking results from the analytical laboratory. Thirteen out of 28 sites reported they had procedures to calculate doses in emergency situations. These procedures had been independently verified as being adequate by 54% of these sites. Eighty-two percent of the applicable respondents recorded all dose calculations in log-books as permanent records, and 36% had procedures to check all calculations. Computers were used by 52% of the sites for such calculations and 57% of those verified the computer outputs. Computer programs were fully documented by 64% of these sites.

PROCEDURAL AUDITS

Written audit procedures had been developed by 54% of the facilities, and 61% conducted programs to independently audit compliance with operational procedures. A management audit of emergency preparedness was reported to be performed by DOE at 19 sites, by the contract general manager at four sites, by the plant manager at five sites, by the department manager at six sites, and by the emergency planner at eight sites. Management at 41% of the facilities was primarily responsible for assuring that audit findings, recommendations, and corrective actions were implemented. This was the responsibility of the QA office at only two sites.

DOCUMENTATION

A central repository was provided for all QC records by 32% of the facilities while 57% maintained the records at separate locations within their organization. Of the 17 sites that responded to the question on records retention periods, 12 sites reported 75 or more years and five sites reported 5 years or less.

SUMMARY

The quality control of instruments, measurements, samples, and records should be maintained at all of the DOE contractor sites. Instruments should be calibrated and samples should be properly labeled to ensure accurate and valid measurement data. Written procedures should be developed for performing certain tasks to ensure uniform, unbiased measurements. However, QC procedures appear to be lacking at many DOE sites. Additional guidance may be needed for:

- written procedures for calibration of equipment, for operation of equipment, for sample collecting, preserving, packaging, and labeling, and for audits
- preventative maintenance schedules for equipment
- operational checks of equipment
- calibration techniques
- length of time to receive the results of personnel-dosimeter processing during an emergency
- ability to calculate doses during an emergency and procedures to check calculations
- auditing programs
- maintenance of QC records.

CONCLUSIONS

The analysis of the responses to the DOE emergency preparedness questionnaire revealed a number of areas that may warrant review. Based on these findings, it is recommended that there be a:

- review of provisions for media, local, state, and federal cooperation and assistance during emergencies
- review of emergency-response-training programs
- review of meteorological measurement capabilities and techniques

- review of quality assurance programs and quality control techniques, especially in the areas of effluent monitoring and environmental surveillance
- review of the performance criteria for emergency radiological instrumentation ensure that such instrumentation will operate satisfactorily under DBA conditions
- review emergency instrumentation presently in use to assure that it meets state-of-the-art specifications and applicable standards
- review of emergency instrument calibration and testing procedures to ensure that such instrumentation will operate satisfactorily during emergency conditions.

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APPENDIX A

SUMMARY OF DOE ORDER 5500.2 - ATTACHMENT 2, "EMERGENCY PLANNING,
PREPAREDNESS, AND RESPONSE FOR OPERATIONS - GENERAL REQUIREMENTS"

APPENDIX A

SUMMARY OF DOE ORDER 5500.2 - ATTACHMENT 2, "EMERGENCY PLANNING, PREPAREDNESS, AND RESPONSE FOR OPERATIONS - GENERAL REQUIREMENTS"

1. Organization

An emergency organizational structure is required as part of the emergency plan; individual authorities and responsibilities are to be defined; an annual review of the emergency program is required; an emergency planning staff is required to review emergency plans annually.

[a] A succession of authority is required.

[b] Assignments to individuals or groups are required for:

- (1) coordination of planning and preparedness activities with Federal, State/local, and contractors
- (2) development of mutual assistance agreements with appropriate agencies
- (3) maintenance and control of emergency plans
- (4) appraisal of contractors' emergency programs
- (5) review of field organization emergency programs
- (6) Identification of telecommunication resources (communication channels are not identified).

[c] An Emergency Operations Center with supporting staff and communications is required.

[d] Duty officers are to be appointed, and authority and responsibilities are to be defined. They have the authority to take initial predetermined actions and must know from whom aid can be requested.

2. Emergency Plans and Procedures

Credible emergencies are to be identified, described, and listed in the emergency plan. The following plans must be maintained current.

[a] Emergency plans shall include:

- (1) written plans for entire site, major areas, plant facility or operation
- (2) Identification of potential credible emergencies.

- (3) specifically emergency plans shall:
 - (a) specify authorities, responsibilities and actions by facility personnel, DOE emergency coordinator, and contractor
 - (b) establish methods for onsite and offsite emergency notification and coordination (Note: The notification and coordination should refer to the accident classification scheme in 5500.3 Section 6)
 - (c) specify levels or limits for potential hazards requiring protective actions
 - (d) identify conditions that could lead to initiation of offsite plans
 - (e) identify communication requirements and assets.
- (4) facility emergency plans consistent with area and site emergency plans
- (5) site emergency plans that are coordinated with those of offsite and governmental organizations
- (6) conditions for shutdown of facility or placing in safe condition
- (7) informational material necessary for understanding the plans (e.g., maps, diagrams, etc.)
- (8) resources available from offsite sources
- (9) provisions for public information and implementation and coordination of same.

[b] Procedures shall include:

- (1)(a-h,j,k) evacuation or sheltering and accountability of personnel
- (1)(i) provisions for securing classified matter, source, by-product, and special nuclear material
- (2)(a-c) procedures for receipt, dissemination, verification, coordination, and review of notification systems
- (3)(a-b) procedures for appropriate safeguards and security including periodic review and update
- (4)(a-b) provisions for personnel monitoring and decontamination
- (5) provisions for medical emergency response
- (6) designation of equipment, personnel, and facilities for damage control
- (7) reentry plans are required and shall include:

- (a) designation of authority and responsibility
- (b) radiation and toxic exposure guides
- (c,d) technical group for evaluation
- (e) available current operating records
- (f) rescue personnel and equipment
- (g) provisions for interviewing evacuated employees
- (h) readily accessible location for emergency equipment and records

(8) provisions for damage assessment.

3. Emergency Facility Requirements

The following facilities shall be established based on the magnitude of potential accidents:

- (a) Emergency Operations Center
- (b) Emergency Control Center
- (c) Emergency Control Station
- (d) Medical Emergency Facility.

4. Emergency Communications

(a-d) An adequate emergency communications system with provisions for contracting all onsite and offsite groups that may be involved and with back-up capability shall be established.

5. Emergency Resources

(a) Emergency equipment is required as follows:

- (1-3) primary and back-up equipment to determine the seriousness of an accident--it shall be readily accessible and protected
- (4) the equipment shall be regularly inspected, tested, and maintained
- (5) power requirements shall be identified
- (6) emergency equipment shall be available as appropriate for:
 - (a,b) emergency dosimetry and emergency monitoring of personnel, facilities, and onsite and offsite environment
 - (c) first aid treatment
 - (d) equipment for meteorological evaluation
 - (e) handling contaminated personnel, toxic material, and fatalities
 - (f) supplying emergency power, water, and sanitation
 - (g) emergency transportation for evacuated personnel

(h,i) location and disposal of explosive devices and movement of earth or heavy loads

(j) emergency communications

(7) emergency equipment is to be the same as regular equipment to the extent practical

[b] Teams of trained personnel are required for specialized services (reentry, recovery, shutdown).

6. Emergency Training

[a](1-5) Training programs for cadres, management, and emergency personnel are required and shall include replacement personnel, retraining, and training exercises.

[b](1-6) Training of offsite emergency response organizations is required.

7. Emergency Tests and Exercises

[a] Tests and exercises are required for the identified potential credible emergencies and shall include:

- (1) notification, activation procedures
- (2,3) evacuation, assembly, sheltering
- (4) activation of emergency control centers and communication channels
- (5) onsite shelter areas management
- (6) damage assessment
- (7) first aid
- (8) facility shutdown
- (9) communications
- (10) personnel, environmental monitoring
- (11) use of equipment
- (12) rescue, reentry
- (13) hazards evaluation
- (14) public information
- (15) consequence assessment

[b-d] Scenarios shall not be revealed, communications during exercise shall be prefaced as being an exercise, and critiques and evaluations shall be documented.

8. Liaison and Coordination With Other Agencies

[a,b] Mutual written agreements/understandings shall be developed and put in writing and emergency plans coordinated between the facility and offsite agencies.

9. Classification

[a,b] Classification guidance shall be prepared and documents and public announcements reviewed for classification.

10. Public Information

- [a,b] Written procedures shall be established for public information releases. Releases shall be coordinated with DOE field offices.
- [c,d] Points of contact for information to the news media shall be provided on a 24-hour basis. Provision shall be made for immediate and subsequent press releases to the news media.

APPENDIX B

DOE FACILITY EMERGENCY PREPAREDNESS

QUESTIONNAIRE DATA COMPILATION

APPENDIX B

DOE FACILITY EMERGENCY PREPAREDNESS

QUESTIONNAIRE DATA COMPILATION

The data compilation uses a system for classifying facilities identical to the system used in the 1971 report. All facilities were classed as HIGH, MEDIUM, or LOW based on the severity of potential accidents. The hazard-potential classification was keyed to the inventory of radioactive materials at each site and not the probability of an accident. The facilities with the largest inventories of radioactive materials, e.g., production reactors and chemical processing plants, were placed in the HIGH-severity group. Conversely, the facilities with the smallest inventories, e.g., research reactors and gaseous diffusion plants, were placed in the LOW-severity group. The facilities with inventories in the middle, e.g., laboratories and weapons testing sites, were placed in the MEDIUM-severity group. As stated in BNWL-1552, "The assignment of severity grouping was not made according to a rigorous or rigid scheme but according to the discretion and professional opinion of the reviewers." This statement also applies to the classification scheme presented in this report. The total number of respondents per severity class in 1980 are shown below.

HAZARD-POTENTIAL CLASSIFICATION

<u>Classification</u>	<u>Description</u>	<u>Total Number of Respondents</u>
High	Large inventory of radioactive materials, e.g., production reactors and chemical processing plants	10
Medium	Medium inventory of radioactive materials, e.g., laboratories and weapons testing facilities	6
Low	Small inventory of radioactive materials, e.g., gaseous diffusion plants and research reactors	<u>14</u>
	Total	30

MODULE 1

EMERGENCY PLANNING RESPONSIBILITIES

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
1.1 At what management level of the operating contractor is the responsibility for emergency planning assigned?				
1) General Manager	0	4	0	4
2) Plant Manager	0	0	2	2
3) E.P. Specialist or Manager	7	1	8	16
4) Fire Chief	1	0	4	5
5) Others?	<u>2</u>	<u>1</u>	<u>0</u>	<u>3</u>
Total Observations	10	6	14	30
1.2 Is emergency planning the primary assignment of the emergency planner?				
Yes	9	2	8	19
No	<u>1</u>	<u>4</u>	<u>6</u>	<u>11</u>
Total Observations	10	6	14	30
a. How much time does he spend on emergency planning?				
1) Essentially full time	3	1	2	6
2) More than 75% of time	2	1	2	5
3) More than 50% of time	2	0	2	4
4) More than 25% of time	1	0	2	3
5) Less than 25% of time	0	0	0	0
6) Not Applicable	1	4	6	11
7) No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
1.3 Is the emergency planner responsible for the following?				
a. Preparation of the Emergency Plan				
Yes	10	5	14	29
No	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
b. Updating of the Emergency Plan				
Yes	10	5	14	29
No	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
c. Planning of drills				
Yes	9	6	12	27
No	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
d. Planning of exercises				
Yes	10	6	12	28
No	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30
e. Review of critiques of drills and exercises				
Yes	10	6	14	30
No	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30
1.4 Who reviews and approves the emergency plans? Check all that apply.				
a. Site manager for DOE	4	2	5	11
b. Operating Contractor Manager	4	4	6	14
c. Plant Manager	8	1	10	19

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
d. Emergency Planner	10	4	11	25
e. Others? Specify:				
Manager, Lab Support	0	0	1	1
Emergency Rev. Comm.	3	1	4	8
Audit Comm.	0	0	1	1
Facility Managers	0	1	1	2
Division Managers	0	1	1	2
Safety Director	1	1	3	5
1.5 Is there a person assigned the responsibility for emergency response training?				
Yes	10	5	13	28
No	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
a. Title of person assigned:				
Health Director	0	0	1	1
Training Manager	2	1	1	4
Emergency Planning Coordinator	5	2	1	8
Lab Shift Supervisor	0	0	1	1
Fire Chief	1	0	2	3
Division Chief	0	0	1	1
General Operations Manager Assist	0	1	1	2
Several Involved	1	0	1	2
Manager, Power Reactor Training Branch	1	0	0	1
Shift Superintendent	0	0	4	4
Not Applicable	0	1	1	2
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
b. How much of their time is devoted to this assignment?				
1) 100% of their time	0	0	0	0
2) 75% or more of their time	0	0	0	0
3) 50% or more of their time	3	1	2	6
4) 25% or more of their time	1	1	4	6
5) Less than 25% of their time	6	1	7	14
Not Applicable	0	2	1	3
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

		<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
		<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
1.6	Is there a defined emergency training curriculum?				
	Yes	6	3	8	17
	No	4	2	6	12
	No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
	Total Observations	10	6	14	30
a.	Who reviews and approves the training program? Check those that apply.				
	1) Corporate Management	7	4	9	20
	2) Plant Manager	2	0	5	7
	3) Site Manager	3	1	2	6
	4) Emergency Planner	6	3	7	16
	5) Training Officer	4	1	7	12
1.7	Are provisions for the following support functions included in your emergency planning?				
a.	Financial assistance				
	Yes	6	2	8	16
	No	<u>4</u>	<u>4</u>	<u>6</u>	<u>10</u>
	Total Observations	10	6	14	30
b.	Legal assistance				
	Yes	7	3	9	19
	No	3	3	4	10
	Not Applicable	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
	Total Observations	10	6	14	30
c.	Public relations				
	Yes	9	5	13	27
	No	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
	Total Observations	10	6	14	30
d.	Media liason				
	Yes	9	4	13	26
	No	1	2	0	3
	Not Applicable	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
	Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
e. State and Federal Assistance				
Yes	7	3	8	18
No	3	3	5	11
Not Applicable	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

f. Administrative support				
Yes	10	5	13	28
No	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

1.8 Are simulated exercises planned for accident scenarios that are likely to occur on your site?

Yes	10	5	13	28
No	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

If yes, check frequency.

1) Bimonthly	1	0	1	2
2) Semiannual	3	1	3	7
3) Annual	6	3	8	17
4) 18 months	0	0	0	0
5) 2 years	0	1	0	1
6) Greater than 2 years	0	0	0	0
7) Not Applicable	0	1	1	2
8) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

1.9 Are drills included in the planning for site emergency teams?

Yes	10	6	12	28
No	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30

If yes, indicate the frequency.

1) Bimonthly	1	0	1	2
2) Quarterly	2	0	2	4
3) Semiannually	1	1	1	3

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
4) Annually	6	3	6	15
5) Greater than annually	0	2	0	2
6) Variable	0	0	1	1
7) Not Applicable	0	0	2	2
8) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

1.10 Are drills included in the planning for facility emergency?

Yes	10	6	13	29
No	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

If yes, indicate the frequency.

1) Bimonthly	1	0	0	1
2) Quarterly	2	0	4	6
3) Semiannually	1	0	2	3
4) Annual	6	3	6	15
5) Greater than annual	0	2	1	3
6) Variable	0	1	0	1
7) Not Applicable	0	1	1	1
8) No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

1.11 Is quality assurance for the emergency plan integrated into your emergency planning?

Yes	7	5	5	17
No	<u>3</u>	<u>1</u>	<u>9</u>	<u>13</u>
Total Observations	10	6	14	30

MODULE 2

ADMINISTRATION OF IN-PLANT EMERGENCIES

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
2.1 Do you have a training emergency planning specialist assigned to emergency planning?				
Yes	7	5	8	19
No	3	1	5	10
Not Applicable	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
How Many?				
1) less than 1 full time	6	5	4	15
2) 1 full time	1	0	0	1
3) 2 full time	0	0	3	3
4) 3 full time	0	0	0	0
5) more than 3 full time	0	0	1	1
6) Not applicable	<u>3</u>	<u>1</u>	<u>6</u>	<u>10</u>
Total Observations	10	6	14	30
2.2 Which of the following received training on how to respond to emergency signals and action required? Check all that apply.				
a. Management	10	6	13	29
b. Emergency control and recovery personnel	9	6	13	28
c. All personnel other than management	9	6	11	26

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
2.3 Administration of emergency plan implementation				
a. Who is responsible for declaring the emergency and for implementing the emergency control action?				
1) Duty Officer	0	1	4	5
2) Plant Manager	3	2	3	8
3) General Manager	1	1	1	3
4) Shift Supervisor	3	1	2	6
5) Other, specify:				
a) Shift Superintendent	1	0	4	5
b) DOE Manager	1	1	0	1
c) First to recognize emergency	1	0	0	1
d) All personnel	1	0	1	2
e) Emergency Supervisor/Coordinator	0	2	2	4
f) Operation Control Center	0	1	0	1
g) Area Warden/Emergency Supervisor	0	2	0	2
h) Disaster Control Officer	0	1	0	1
i) Security Director	0	1	0	1
j) Security Patrol Supervisor	0	0	0	0
k) Head, Health Protection	0	0	1	1
l) Fire Protection Supervisor	1	1	0	2
m) Fire Department	0	0	0	0
n) Senior Fire Officer	1	0	0	1
6) Not Applicable	0	0	1	1
b. Who is responsible for activation of the emergency plan after the notification of an emergency condition?				
1) Duty Officer	2	1	3	6
2) Plant Manager	5	1	1	7
3) General Manager	2	0	1	3
4) DOE Site Manager	2	1	1	4
5) Other				
a) Shift Superintendent	1	0	4	5
b) Emergency Planning Coordinator	1	1	2	4
c) Emergency Officer/Supervisor/Coordinator	1	1	0	2
d) Building/Area Emergency Supervisor	0	1	2	3
e) Disaster Control Office	0	1	0	1
f) Cadre Member	0	1	0	1
g) Emergency Response Group Director	1	1	0	2
h) Shift Supervisor	0	1	0	1

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
i) Guard Headquarter	0	0	0	0
j) Security Patrol	1	1	0	2
k) Shift Cascade Coordinator	0	0	0	0
l) Head, Health Protection	0	0	1	1
m) Senior Fire Officer	1	0	0	1
6) Not Applicable	0	0	1	1
7) No Response	1	0	0	1

2.4 What emergency support centers are manned by key personnel when an emergency condition exists? Check all that apply.

a. Control Room of facility experiencing the emergency condition	5	4	9	18
b. Support center in facility experiencing the emergency	6	2	4	12
c. Offsite Emergency Center	6	2	6	14
d. Media and Public Information Center	7	3	6	16
e. Mobile and Field Support Unit	7	2	9	18
f. Others, specify:				
1) Emergency Operations Center	2	1	3	6
2) Tactical Command Center	2	0	1	3
3) Central Control Facility	1	3	3	7
4) Mercury Control Center	0	1	0	1
5) Base Camp Office	0	0	0	0
6) Emergency Room	0	1	0	1
7) Health Service	0	0	1	1
8) Emergency Staging Area	1	0	0	1

2.5 When offsite support teams are rendering assistance to onsite emergency personnel, where do they interface with site emergency centers? Check all that apply.

a. Offsite Emergency Center	4	3	1	8
b. Onsite Emergency Center	6	5	10	21
c. Through field emergency center	7	1	6	14

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

d. Others, specify:

1) Plant Emergency Relocation Center	0	0	1	1
2) DOE Headquarters	0	0	1	1
3) Plant Control Center	1	1	1	3
4) Security Patrol	0	1	1	2

2.6 When an emergency exists onsite, are local support groups, such as the fire department, city police and sheriffs, notified of the conditions?

Yes	7	4	9	20
No	2	1	5	8
No Response	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

a. Do agreements exist for assistance from local support agencies?

Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

2.7 If offsite consequences are either detected or anticipated, how is the notification of state and local agencies handled?

a. By the responsible contractor

Yes	1	0	2	3
No	2	1	5	8

b. By the emergency director

Yes	4	0	5	9
No	1	1	3	5

c. By DOE site manager

Yes	8	4	11	23
No	0	0	1	1

d. By DOE Headquarters

Yes	3	0	0	3
No	1	1	6	8

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
e. Others:				
1) DOE	0	1	2	3
2) Support Contractor	0	1	0	1
3) Public Communication Coordinator	0	0	1	1
4) State Emergency Service	1	0	0	1

2.8 Do you have approved procedures for implementing the emergency plan for each plant or plant operations?

Yes	10	6	12	28
No	0	0	1	1
Not Applicable	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

a. Are the implementing procedures reviewed and approved by the corporate manager?

Yes	3	5	3	11
No	5	1	7	13
Not Applicable	0	0	2	2
No Response	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30

b. By plant management?

Yes	8	5	10	23
No	1	0	1	2
Not Applicable	0	0	2	2
No Response	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30

c. Are the implementing procedures included in drills?

Yes	9	3	10	22
No	0	0	0	0
Not Applicable	0	0	2	2
No Response	<u>1</u>	<u>3</u>	<u>2</u>	<u>6</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
d. Are the implementing procedures included in critique of drills?				
Yes	9	6	11	26
No	0	0	0	0
Not Applicable	0	0	2	2
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

2.9 Are approved emergency plans in existence for each of the counties that might be affected by a release of radioactivity?

Yes	8	2	4	14
No	0	0	8	8
Not Applicable	0	1	1	2
No Response	<u>2</u>	<u>3</u>	<u>1</u>	<u>6</u>
Total Observations	10	6	14	30

a. Are the counties responsible for evaluation of conditions and for initiating protective action for the public?

Yes	6	1	4	11
No	1	0	2	3
Not Applicable	0	1	8	9
No Response	<u>3</u>	<u>4</u>	<u>0</u>	<u>7</u>
Total Observations	10	6	14	30

b. Do the responsible officers for the counties have training and the background necessary to make these judgements?

Yes	4	1	2	7
No	2	0	2	4
Not Applicable	0	1	9	10
No Response	<u>4</u>	<u>4</u>	<u>1</u>	<u>9</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
2.10 Does the state agency assume responsibility for offsite control of the emergency?				
Yes	5	2	8	15
No	1	0	3	4
Not Applicable	0	1	1	2
No Response	<u>4</u>	<u>3</u>	<u>2</u>	<u>9</u>
Total Observations	10	6	14	30

a. What agency has this responsibility?

1) State Dept. of Emergency Service	1	0	0	1
2) State Civil Defense	0	0	3	3
3) State Dept. Public Health	0	1	2	3
4) State Disaster Service	1	0	2	3
5) Department of Public Safety	1	0	0	1
6) DOE Operations Office	1	0	0	1
7) County Civil Defense	1	0	0	1
8) Local Disaster Services	0	0	1	1
9) Not Applicable	1	1	4	6
10) No Response	<u>4</u>	<u>4</u>	<u>2</u>	<u>10</u>
Total Observation	10	6	14	30

b. What is the line of authority?

1) DOE-State-FEMA	0	0	2	2
2) Governor	1	0	4	5
3) DOE-State	1	0	1	2
4) California Administration Code	0	0	1	1
5) Dept. of Public Safety-Governor	1	0	0	1
6) Plant Management	1	0	1	2
7) Not Applicable	1	1	4	6
8) No Response	<u>5</u>	<u>5</u>	<u>1</u>	<u>1</u>
Total Observation	10	6	14	30

2.11 Is protective action for the residents of the county the responsibility of county government?

Yes	7	1	10	18
No	0	0	1	1
Not Applicable	2	1	1	4
No Response	<u>1</u>	<u>4</u>	<u>2</u>	<u>7</u>
Total Observation	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
a. Do the sheriff's local law enforcement agencies have sufficient resources to handle the population at risk?				
Yes	6	1	5	12
No	0	0	2	2
Not Applicable	2	1	2	5
No Response	<u>2</u>	<u>4</u>	<u>5</u>	<u>11</u>
Total Observations	10	6	14	30
2.12 Is there a predefined emergency organization for each onsite operating plant?				
Yes	9	6	13	28
No	0	0	0	0
Not Applicable	1	0	0	1
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
2.13 Does the plant emergency organization provide and define responsibilities for obtaining the emergency support services?				
Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
Are the following services included?				
a. Fire fighting				
Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
b. Bomb squad				
Yes	10	4	13	27
No	0	1	0	1
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
c. Security force backup				
Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
d. Transportation buses				
Yes	10	5	9	24
No	0	1	4	5
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
e. Heavy equipment				
Yes	10	4	11	25
No	0	2	2	4
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

2.14 Does the plant emergency organization include the following on-plant support?

a. Electrical and mechanical maintenance				
Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
b. Technical assistance				
Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
c. Health physics				
Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
d. Nuclear safety				
Yes	10	6	12	28
No	0	0	1	1
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
e. Industrial safety and hygiene				
Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
f. Medical support				
Yes	10	6	13	29
No	0	0	0	0
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
g. Security				
Yes	10	6	12	28
No	0	0	1	1
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
h. Bomb squad				
Yes	10	4	3	17
No	0	1	10	11
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
2.15 As the manager of plant operations, are you satisfied that you have the needed information readily available to permit prompt action to control emergencies that may arise?				
1) Very dissatisfied	0	0	0	0
2) Dissatisfied	0	0	0	0
3) Slightly dissatisfied	0	0	0	0
4) Neither	0	0	2	2
5) Slightly satisfied	2	1	0	3
6) Satisfied	7	4	8	19
7) Very satisfied	1	1	2	4
8) No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30
2.16 Do you have a manual on evacuation plans?				
Yes	9	6	12	27
No	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
a. Does it include evacuation routes?				
Yes	8	5	12	25
No	1	1	0	2
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
b. Does it include a current emergency communication call list?				
Yes	9	6	11	26
No	0	0	0	0
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
c. Does it include a map of emergency kits and contents?				
Yes	6	3	5	14
No	2	2	7	11
Not Applicable	2	0	1	3
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
d. Does it include assembly points for personnel?				
Yes	9	6	11	26
No	0	0	1	1
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
e. Does it provide for a radiation survey of personnel?				
Yes	9	4	11	24
No	0	2	0	2
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30
f. Are vehicles and drivers available at all times to permit evacuation to the assembly point?				
Yes	7	4	5	16
No	0	2	5	7
Not Applicable	3	0	3	6
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
2.17 Is the information you require to be effective in an emergency readily accessible to you?				
Yes	9	6	11	26
No	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
2.18 Do you feel that you have had adequate training to manage emergency situations?				
Yes	8	6	11	25
No	1	0	1	2
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
2.19 Which of the following subjects are covered in your emergency training program?				
a. DOE accident-reporting requirements				
Yes	8	6	10	24
No	1	0	3	4
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
b. Notification requirements for Federal, State, and local agencies				
Yes	4	3	9	16
No	5	3	3	11
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
c. Accident classification				
Yes	8	4	9	21
No	0	2	4	6
No Response	<u>2</u>	<u>0</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30
d. Conditions requiring evacuation				
Yes	9	5	12	26
No	0	1	1	2
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
e. Evacuation plan and routes to be followed				
Yes	9	5	12	26
No	0	1	1	2
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
f. Personnel accountability				
Yes	9	5	11	25
No	0	1	2	3
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
g. Reassembly points				
Yes	8	5	10	23
No	1	1	2	4
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
h. Requirement for survey and decontamination				
Yes	9	5	9	23
No	0	1	2	3
No Response	<u>1</u>	<u>0</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30
i. Contents and location of emergency kits				
Yes	7	5	8	20
No	1	1	5	7
Not Applicable	1	0	0	1
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
j. Procedures for transporting contamination to medical facilities				
Yes	9	5	8	22
No	0	1	2	3
Not Applicable	0	0	1	1
No Response	<u>1</u>	<u>0</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30
k. Evaluation of the hazards to the public and public domain as a result of a release of radioactive material to the atmosphere				
Yes	6	3	8	17
No	3	3	3	9
Not Applicable	0	0	1	1
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
l. The procedure to be followed in initiating protective action onsite				
Yes	9	5	12	26
No	0	1	1	2
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
m. The procedure to be followed ini- tiating protective action to the public in the plume pathway				
Yes	5	1	9	15
No	4	5	2	11
Not Applicable	0	0	1	1
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
n. Re-entry criteria				
Yes	9	4	9	22
No	0	2	3	5
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
o. Recovery plans				
Yes	8	4	8	20
No	1	2	4	7
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
p. Specialty teams available and their area of expertise				
Yes	9	6	10	25
No	0	0	2	2
Not Applicable	0	0	1	1
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
2.20 Have drills prepared you adequately to deal with the actual emergencies that may arise in the plant that you manage?				
Yes	8	6	11	25
No	1	0	2	3
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
2.21 Is effective support available from local DOE staff to supplement your emergency control personnel?				
Yes	10	6	7	23
No	0	0	6	6
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

2.22 Does the emergency plan for your plant and site provide an adequate workable framework for effective emergency response by your staff?

1) Inadequate	0	0	1	1
2) Barely adequate	0	0	0	0
3) Adequate	7	4	7	18
4) Very adequate	2	2	5	9
5) No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

MODULE 3

OFFSITE TRANSPORTATION ACCIDENTS

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
3.1 Do you have an emergency plan to render assistance in the event of an offsite accident involving shipment of radioactive or hazardous materials originating from your site?				
Yes	5	3	12	20
No	0	1	1	2
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30
3.2 Do you provide emergency instruction to law enforcement agencies in your area?				
Yes	3	1	5	9
No	2	3	8	13
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30
3.3 Do you provide emergency training for the law enforcement agencies in your area?				
Yes	2	1	3	6
No	3	3	10	16
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30
3.4 Have you established a financial plan to provide the funds required to handle an offsite shipping accident?				
Yes	1	1	3	5
No	3	2	10	15
Not Applicable	6	3	1	10
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
3.5 For offsite transportation accidents, do procedures exist to do the following:				
a. Coordinate facility response through a designated emergency officer?				
Yes	5	3	12	20
No	0	0	1	1
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
b. Respond with a team of appropriately trained individuals?				
Yes	5	1	11	17
No	0	2	2	4
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
c. Notify the following federal agencies of transportation accidents involving hazardous materials:				
DOE?				
Yes	5	4	12	21
No	0	0	1	1
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30
NRC?				
Yes	1	0	2	3
No	4	3	10	17
Not Applicable	5	2	2	9
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
DOT?				
Yes	3	1	6	10
No	2	2	6	10
Not Applicable	5	2	2	9
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
EPA?				
Yes	3	2	3	8
No	2	2	10	14
Not Applicable	5	1	1	7
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

d. Notify state and local agencies:

1) State police?

Yes	3	2	8	13
No	2	2	5	9
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

2) Governor's office?

Yes	2	1	4	7
No	3	2	9	14
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

3) Designated state emergency operations office/center?

Yes	2	2	7	11
No	3	1	6	10
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

4) County sheriff?

Yes	4	1	6	11
No	1	2	7	10
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

5) Local (county) emergency operations office/center?

Yes	5	1	7	13
No	1	1	6	8
Not Applicable	4	3	1	8
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
3.6 Has an emergency classification scheme for offsite transportation accidents been established at your site?				
Yes	0	1	3	4
No	4	2	10	16
Not Applicable	5	2	1	8
No Response	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30
3.7 Would you favor the establishment of a uniform DOT emergency classification system?				
Yes	3	3	12	18
No	1	1	1	3
Not Applicable	5	2	1	8
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
3.8 Have drills been held to evaluate the effectiveness of your response to an offsite transportation accident?				
Yes	2	2	2	6
No	3	2	11	16
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30
3.9 How satisfied are you with your system of responding to offsite transportation accidents?				
1) Very dissatisfied	0	0	0	0
2) Dissatisfied	0	0	0	0
3) Slightly dissatisfied	0	0	1	1
4) Neither dissatisfied nor satisfied	2	1	2	5
5) Slightly satisfied	0	1	0	1
6) Satisfied	3	0	8	11
7) Very satisfied	0	1	1	2
8) Not Applicable	5	3	1	9
9) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
3.10 How many transportation accidents have occurred involving shipments of radioactive material to/from your facility in the past?				
a. Onsite				
1) 0	4	3	12	19
2) 1	1	0	1	2
3) Not Applicable	5	2	0	7
4) No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
b. Offsite				
1) 0	3	3	6	12
2) 1	1	0	0	1
3) 2	1	0	1	2
4) 3	0	0	1	1
5) 4	0	0	2	2
6) 5	0	0	2	2
7) Not Applicable	5	2	1	8
8) No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
3.11 Have you responded to an offsite transportation accident?				
Yes	5	2	10	17
No	0	2	3	5
Not Applicable	5	2	1	8
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30
a. Do you critique your response in order to improve your capability?				
Yes	5	2	9	16
No	0	0	1	1
Not Applicable	5	4	4	13
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

MODULE 4

ONSITE RADIOACTIVE MATERIAL SHIPMENTS

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
4.1 When do you require radiation monitoring personnel to accompany on-plant shipments of radioactive materials?				
1) Never	3	1	7	11
2) Always	1	0	2	3
3) DOT-Safety Requirement	1	0	0	1
4) Weapons Convoys	0	0	1	1
5) Surface Dose 200 mrem/hr	0	1	0	1
6) Rad. Scrap, Waste, Nu	0	1	1	2
7) Heavy Equipment Requirement	0	0	1	1
8) 50 mrem/h Package	1	0	0	1
9) Sufficient Risk	2	2	1	5
10) Package Reads 500 mrem/hr at 3ft.	1	0	0	1
11) Low-Level Liquid Waste	1	0	0	1
12) Not Applicable	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
4.2 Are appropriate radiation monitoring instruments available on shipment vehicles?				
Yes	7	3	5	15
No	3	2	7	12
Not Applicable	0	1	2	2
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
4.3 Is the transport crew trained in the proper operation and interpretation of monitoring instruments?				
Yes	8	2	6	16
No	2	3	6	11
Not Applicable	0	1	1	2
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
a. How often are the transport crew retrained in the operation and interpretation of monitoring instruments?				
1) Quarterly	1	0	1	2
2) Semi-annually	1	0	0	1
3) Annually	1	1	3	5
4) Not at all	5	4	7	16
5) Bi-annually or less	1	0	1	2
6) Not Applicable	0	1	1	4
7) No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>0</u>
Total Observations	10	6	14	30

4.4 How would on-plant shipment accidents be reported?

1) Emergency Response Team	2	2	1	5
2) Security	0	1	0	1
3) Health Division, Security	1	0	0	1
4) Drivers Supervisor	0	1	1	2
5) Plant Management (Health)	1	0	1	2
6) Plant Management (DOE)	0	0	1	1
7) Lab Management	0	1	1	2
8) DOE	0	0	0	0
9) RM Office, Patrol	4	0	2	6
10) Hazards Control	0	0	1	1
11) Through Warning Communication Center to Management	2	0	1	3
12) E.H.&S. Head and Director	0	0	3	3
13) Not Applicable	0	1	1	3
14) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
4.5 How satisfied are you with your onsite radioactive shipment procedures?				
1) Very dissatisfied	0	0	0	0
2) Dissatisfied	0	1	0	1
3) Slightly dissatisfied	0	0	0	0
4) Neither dissatisfied nor satisfied	0	0	0	0
5) Slightly satisfied	0	0	1	1
6) Satisfied	7	3	8	18
7) Very satisfied	3	1	3	7
8) Not Applicable	0	1	1	2
9) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

MODULE 5

MEDICAL TREATMENT ARRANGEMENTS

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
5.1 Do you have access to medical treatment facilities other than industrial first aid stations?				
Yes	8	6	12	26
No	0	0	0	0
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30
5.2 Does the medical facility have radiation detection and monitoring equipment?				
Yes	8	6	12	26
No	0	0	0	0
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30
5.3 Have you made arrangements for outside medical assistance?				
Yes	8	5	11	24
No	0	0	1	1
Not Applicable	<u>2</u>	<u>1</u>	<u>2</u>	<u>5</u>
Total Observations	10	6	14	30
5.4 Does a formal agreement for medical assistance exist?				
Yes	7	6	11	24
No	1	0	1	2
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
5.5 Does the offsite medical facility or hospital agree to accept contaminated patients for treatment?				
Yes	8	6	11	25
No	0	0	0	0
Not Applicable	2	0	2	4
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
5.6 Do you feel the offsite medical support staff is sufficiently knowledgeable in radiation protection?				
Yes	6	4	9	19
No	1	1	2	4
Not Applicable	2	0	2	4
No Response	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30
5.7 Are emergency training sessions conducted with offsite medical support personnel?				
Yes	6	1	7	14
No	2	4	4	10
Not Applicable	2	0	2	4
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
5.8 Are there industrial first aid stations located onsite?				
Yes	7	4	10	21
No	1	0	2	3
Not Applicable	2	0	2	4
No Response	<u>0</u>	<u>2</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30
5.9 Are radio communication systems established which permit field request for medical assistance?				
Yes	8	6	11	25
No	0	0	1	1
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
5.10 Is the release of medical information coordinated between the operating contractor and the offsite medical center?				
Yes	8	5	10	23
No	0	1	2	3
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30
5.11 Which of the following dosimetry capabilities are available on or near site?				
a. Chest counting				
Yes	6	5	9	20
No	1	1	3	5
Not Applicable	2	0	2	4
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
b. Whole body counting				
Yes	6	4	12	22
No	2	2	0	4
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30
c. Wound counting				
Yes	8	6	10	24
No	0	0	2	2
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30
d. Bioassay of blood, feces and urine				
Yes	7	6	12	25
No	1	0	0	1
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
5.12 Is health physics support provided from the site?				
Yes	7	6	12	25
No	1	0	0	1
Not Applicable	<u>2</u>	<u>0</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30

MODULE 6

LIQUID EFFLUENT DISCHARGE MONITORING

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
6.1 Liquid effluent monitoring is conducted				
a. Both <u>continuous detection and monitoring and by sample and analysis</u> . Answer all questions under 6.2 and 6.3 below.	5	1	5	11
b. <u>Continuous detection and monitoring only</u> . Answer questions under 6.2 below and SKIP questions under 6.3 below.	0	0	0	0
c. <u>Sampling and analysis only</u> . SKIP questions under 6.2 below and answer those under 6.3 below.	4	3	5	12
Not Applicable	1	1	2	4
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
6.2 Continuous detection and monitoring				
a. Is the response of the liquid effluent monitor recorded?				
Yes	4	1	4	9
No	1	0	1	2
Not Applicable	5	4	8	17
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
b. If an effluent monitor response occurs, does the high or low response trip an annunciator at a manned location?				
Yes	4	1	4	9
No	1	0	1	2
Not Applicable	5	4	8	17
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
c. Is the flow through the sample chamber proportional to the effluent flow?				
Yes	3	1	3	7
No	2	0	2	4
Not Applicable	5	4	8	17
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
d. What is the average daily discharge of the total flow?				
1) 3.0×10^4 gal/day	1	0	0	1
2) 1.3×10^7 gal/day	1	0	0	1
3) 1×10^6 gal/day	1	0	0	1
4) 4.3×10^8 gal/day	1	0	0	1
5) 1.2×10^6 gal/day	0	0	1	1
6) 3.4×10^5 gal/day	0	0	1	1
7) 1.15×10^6 gal/day	0	0	1	1
8) 8×10^3 gal/day	0	1	0	1
9) 3.5×10^5 gal/day	1	0	0	1
10) Not Applicable	5	4	9	18
11) No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
e. Is the total discharge flow monitored?				
Yes	0	1	2	3
No	5	1	3	9
Not Applicable	5	3	8	16
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
f. Is a sample of the total flow monitored?				
Yes	4	0	2	6
No	1	1	3	5
Not Applicable	5	4	8	17
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

	High	Medium	Low	Total
	Number of Responses	Number of Responses	Number of Responses	Number of Responses
g. What is the volume of the sample monitored?				
1) 0.5 liters	1	0	0	1
2) 1 liter	1	0	0	1
3) 2 liters	1	0	0	1
4) 26 liters	0	0	1	1
5) 32 liters	0	0	1	1
6) 40 liter/minute	1	0	0	1
7) 57,600 liter/day	0	0	1	1
8) Not Applicable	6	5	10	21
9) No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

h. The minimum detection level of the monitoring system is:				
1) 6×10^{-5} $\mu\text{Ci/ml}$	1	0	0	1
2) 1×10^{-3} $\mu\text{Ci/ml}$	1	0	0	1
3) 3×10^{-7} $\mu\text{Ci/ml}$	0	0	0	0
4) 2.5×10^1 $\mu\text{Ci/ml}$	0	0	1	1
5) 3.5×10^{-7} $\mu\text{Ci/ml}$	0	0	1	1
6) 1.0×10^{-5} $\mu\text{Ci/ml}$	1	0	0	1
7) 3.0×10^1 nCi/l (^{239}Pu)	0	0	1	1
8) 2×10^{-7} $\mu\text{Ci/ml}$ (^{137}Cs)	1	1	0	2
9) 3.9×10^{-6} $\mu\text{Ci/ml}$ (^{90}Sr); 2.2×10^{-5} $\mu\text{Ci/ml}$ (^{239}Pu)	1	0	0	1
10) Not Applicable	5	4	8	17
11) No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

6.3 Sampling and analysis of liquid effluents

a. What method of sampling is used?				
1) Continuous, augmented with spot sampling	3	0	2	5
2) Continuous, no spot sampling	1	0	0	1
3) Proportional	4	3	8	15
4) Grab samples	2	1	6	9
5) Other, specify - batch	1	0	1	2
6) All of the above	1	0	0	1
7) Not Applicable	1	1	3	5
8) No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
b. Is the sample proportional to the effluent flow?				
Yes	6	3	7	16
No	3	1	3	7
Not Applicable	1	1	3	5
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
c. Do you only monitor for gross radioactivity?				
Yes	2	0	2	4
No	7	4	9	20
Not Applicable	1	1	2	4
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
d. Is the radioactivity computed to time zero?				
Yes	3	1	3	7
No	6	3	6	15
Not Applicable	1	1	4	6
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
e. What methods do you use to analyze?				
1) Evaporation of sample followed by gross counting of α and β	2	1	0	3
2) Specific Isotopic analysis with standard methods	1	0	2	3
3) Wet chemical analysis/ radiochemistry	1	1	3	5
4) Liquid scintillation	3	4	3	10
5) Gell detector with multichannel analyzer	3	0	0	3
6) NaI with MCA	0	0	0	0
7) Gamma spectrometry	0	2	3	5
8) Alpha spectrometry	3	0	0	3
9) Gross counting of α and β	0	2	5	7
10) Proportional counters	1	0	0	1
11) Fluorometric analysis	0	0	2	2
12) Atomic absorption	1	0	0	1
13) pH	1	0	0	1

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
14) X-ray fluorescence	1	0	0	1
15) Independent commercial lab	0	0	1	1
16) A monthly composite is prepared from the daily proportional samples and analyzed for Sr-90, Sr-89, H-3, I-129, U-235, U-232, Pu-238, Pu-239-240, gamma scan, gross beta, gross alpha	1	0	0	1
17) Not Applicable	2	1	2	5
18) No Response	0	1	1	2

f. What is the average elapsed time between sampling and analysis?

1) 1 hr	1	0	0	1
2) 2 hr	0	0	1	1
3) 4 hr	2	0	0	2
4) 6 hr	1	0	1	2
5) 8 hr	0	1	0	1
6) 24 hr	1	2	2	5
7) 48 hr	0	0	1	1
8) 50 hr	0	0	1	1
9) 63 hr	0	0	1	1
10) 72 hr	0	0	1	1
11) 96 hr	1	0	0	1
12) 168 hr	0	1	1	2
13) 300 hr	0	0	1	1
14) 360 hr	0	0	0	1
15) 720 hr	1	0	0	1
16) Not Applicable	2	1	2	5
17) No Response	<u>1</u>	<u>1</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30

g. The Design Basis Accident (DBA) would cause what concentration in the liquid effluent?

1) >1000 $\mu\text{Ci/ml}$	0	0	1	1
2) >10 ⁻⁶ $\mu\text{Ci/ml}$	0	0	1	1
3) 0 $\mu\text{Ci/ml}$	2	0	1	3
4) 1.9 x 10 ¹ $\mu\text{Ci/ml}$	0	0	1	1
5) 1 x 10 ⁻⁴ $\mu\text{Ci/ml}$	0	0	1	1
6) 2 x 10 ⁻⁴ $\mu\text{Ci/ml}$	1	0	0	1
5) 2.8 x 10 ⁵ $\mu\text{Ci/ml}$	1	0	0	1
6) 6.7 x 10 ⁻⁵ $\mu\text{Ci/ml}$	1	0	0	1
7) Unknown	1	2	1	4

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
8) Not Applicable	3	2	5	10
9) No Response	<u>1</u>	<u>2</u>	<u>3</u>	<u>6</u>
Total Observations	10	6	14	30

h. Will the monitoring system accurately measure this concentration?

Yes	4	0	3	7
No	2	0	1	3
Not Applicable	4	5	7	16
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

6.4 Calibration

a. How often are effluent-monitoring systems calibrated?

1) Daily	1	1	1	3
2) Weekly	2	2	1	5
3) Monthly	1	0	2	3
4) Quarterly	0	0	0	0
5) Annually	1	0	0	1
6) Not at all	1	0	0	1
7) Not Applicable	4	2	5	11
8) No Response	<u>0</u>	<u>1</u>	<u>5</u>	<u>6</u>
Total Observations	10	6	14	30

b. What radioactive sources are used for calibration?

1) Mixed gamma source (^{60}Co , ^{54}Mn , ^{137}Cs , ^{144}Ce)	1	0	1	2
2) ^{137}Cs	3	2	0	5
3) ^{239}Pu	0	1	1	2
4) ^{148}Gd	0	1	0	1
5) ^{152}Eu	0	1	0	1
6) ^3H	0	2	1	3
7) $^{228}\text{Thorium}$	1	0	0	1
8) ^{238}U	1	0	1	2
9) ^{241}Am	1	0	0	1
10) ^{60}Co	2	0	0	2
11) ^{36}Cl	0	0	1	1
12) Flow Calibration Only	0	0	1	1
13) Not Applicable	4	2	5	11
14) No Response	0	1	4	5

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
c. How often are operational checks made?				
1) Every shift	1	0	0	1
2) Daily	4	1	3	8
3) Weekly	1	1	2	4
4) Not at all	0	0	0	0
5) Not Applicable	3	2	6	11
6) No Response	<u>1</u>	<u>2</u>	<u>3</u>	<u>6</u>
Total Observations	10	6	14	30
d. Is the effluent-monitoring system located and housed to provide reliable operations?				
Yes	7	3	5	15
No	0	0	0	0
Not Applicable	3	2	6	11
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30
e. Is the effluent-monitoring sensor placed so it will effectively sense the radioactivity in the liquid stream?				
Yes	4	1	3	8
No	3	2	1	6
Not Applicable	3	2	7	12
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30
Explain:				
Thru steel wall	1	0	0	1
Sample analysis-lab	2	2	1	5
Not Applicable	0	5	10	23
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30
f. How often are the sample-flow-rate measuring systems cleaned and calibrated?				
1) Weekly	0	1	1	2
2) Monthly	1	0	1	2
3) Quarterly	4	1	3	8
4) Annually	1	1	0	2

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
5) Not at all	1	0	0	1
6) Not Applicable	2	2	5	9
7) No Response	<u>1</u>	<u>1</u>	<u>4</u>	<u>6</u>
Total Observations	10	6	14	30

6.5 System Reliability

- a. For your DBA, will the monitoring system be subjected to environmental factors that would affect its performance?

Yes	1	0	0	1
No	5	1	4	10
Not Applicable	3	4	6	13
No Response	<u>1</u>	<u>1</u>	<u>4</u>	<u>6</u>
Total Observations	10	6	14	30

Explain briefly, (e.g., flooding, radiation levels, radioactive fallout)

Earthquake	1	0	1	2
Not Applicable	9	5	10	24
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

- b. Is the monitor connected to a process alarm?

Yes	2	2	4	8
No	5	1	0	6
Not Applicable	3	2	7	12
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

- c. In a manned location, is there an annunciator trip if the set point is exceeded?

Yes	4	2	4	10
No	2	1	0	3
Not Applicable	4	2	7	13
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
d. Does the monitoring system function when grid power fails?				
Yes	5	3	2	10
No	2	0	0	2
Not Applicable	3	2	8	13
No Response	<u>0</u>	<u>1</u>	<u>4</u>	<u>5</u>
Total Observations	10	6	14	30
e. How is back-up power provided?				
1) Manually	2	1	1	4
2) Automatically	3	2	1	6
3) Not Applicable	5	2	8	15
4) No Response	<u>0</u>	<u>1</u>	<u>4</u>	<u>5</u>
Total Observations	10	6	14	30
f. Does the instrument perform erratically during the transition between grid and back-up power?				
Yes	0	2	0	2
No	5	1	2	8
Not Applicable	5	2	8	15
No Response	<u>0</u>	<u>1</u>	<u>4</u>	<u>5</u>
Total Observations	10	6	14	30
g. Who is authorized to deactivate the effluent-monitoring system?				
1) Environmental or Rad Safety	3	2	1	6
2) Operations Group	1	0	0	1
3) Environmental Management Planning	0	0	1	1
4) Health Physics, Emergency Director	0	0	1	1
5) Wet Chemistry	1	0	0	1
6) DOE Radiological Branch	0	1	0	1
7) Appropriate Management	0	0	0	0
8) RML Supervisor	1	0	0	1
9) Not Applicable	4	2	7	13
10) No Response	<u>0</u>	<u>1</u>	<u>4</u>	<u>5</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
h. Is there a QA program to cover the effluent monitoring program?				
Yes	4	3	4	11
No	3	2	0	5
Not Applicable	3	1	6	10
No Response	<u>0</u>	<u>0</u>	<u>4</u>	<u>4</u>
Total Observations	10	6	14	30
i. Is the effluent monitor on a preventative maintenance program?				
Yes	5	2	2	9
No	0	1	1	2
Not Applicable	5	2	7	14
No Response	<u>0</u>	<u>1</u>	<u>4</u>	<u>5</u>
Total Observations	10	6	14	30
j. What is the frequency?				
1) Annually	1	0	0	1
2) Semi-Annually	0	0	0	0
3) Quarterly	1	0	1	2
4) Monthly	1	1	0	2
5) Weekly	0	1	1	2
6) Other	1	0	0	1
7) Not Applicable	5	3	8	16
8) No Response	<u>1</u>	<u>1</u>	<u>4</u>	<u>6</u>
Total Observations	10	6	14	30

6.6 Instrumentation for monitoring liquids discharged to the environment

a. At what frequency are liquid effluents at the boundary of your facility monitored?				
1) Continuously	4	0	4	8
2) Daily	1	0	1	2
3) Weekly	0	1	1	2
4) Monthly	1	1	0	2
5) Quarterly	1	0	0	1
6) Every Discharge	0	1	0	1
7) Not Applicable	3	2	5	10
8) No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
b. Do you release liquid effluents to points beyond your site boundary?				
Yes	3	2	7	12
No	5	2	3	10
Not Applicable	2	1	3	6
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

IF NO, SKIP THE REMAINDER OF THIS
MODULE

c. How often are the liquid streams that are impacted by your facility's liquid effluents monitored in the environment?				
1) Continuously	0	1	3	4
2) Daily	1	0	0	1
3) Weekly	1	0	3	4
4) Monthly	0	0	0	0
5) Never	0	1	0	1
6) Not Applicable	8	3	7	18
7) No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

d. Does the monitoring system provide a means of directly assessing the impact on the stream?				
Yes	1	1	5	7
No	1	1	1	3
Not Applicable	8	3	7	18
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

e. How is your monitoring system used?				
1) Routinely	2	2	3	7
2) Just for emergency conditions	0	0	0	0
3) Not Applicable	8	3	10	21
4) No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

Specify any instrumentation used
for emergencies only.

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
f. When a boundary effluent monitor or sampler gives an elevated response, do you sample downstream potable water supplies?				
Yes	2	0	3	5
No	0	4	3	4
Not Applicable	8	5	6	19
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
g. Do you have an established concentration in the potable water, that if it is exceeded, use of the potable water would be temporarily suspended?				
Yes	2	1	3	6
No	0	0	1	1
Not Applicable	8	4	9	21
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
h. Is it permissible to deactivate the monitoring systems without approval of your health physics staff?				
Yes	0	0	1	1
No	1	1	5	7
Not Applicable	9	3	7	19
No Response	<u>0</u>	<u>2</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30
i. When continuous monitoring systems are used to measure your liquid effluents, what is the range of concentration that can be measured?				
1) 4×10^{-6} $\mu\text{Ci/ml}$ lower limit	1	0	0	1
2) 25 $\mu\text{Ci/ml}$ to 250,000 $\mu\text{Ci/ml}$	0	0	1	1
3) Not Applicable	9	5	10	24
4) No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
j. How often is your environs' liquid monitoring instrumentation calibrated?				
Weekly	1	0	5	6
Quarterly	0	0	1	1
Not Applicable	8	5	7	20
No Response	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30

k. How frequently are the monitoring systems checked to assure that they are operational?

1) Daily	1	1	5	7
2) Monthly	0	0	1	1
3) Quarterly	0	0	0	0
4) Semi-Annually	0	0	0	0
5) Annually	0	0	0	0
6) Not Applicable	8	4	7	19
7) No Response	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30

6.7 Physical Properties

a. Is your instrumentation:

1) Fixed	4	2	3	9
2) Portable	0	0	0	0
3) Both	0	0	3	3
4) Not Applicable	6	3	7	16
5) No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

b. If commercial instrumentation is used, give manufacturer's name and model number.

1) SIRCO, Manning, Harshaw	0	0	1	1
2) Eberline, Harshaw	0	0	1	1
3) Beckman LS-100	0	1	0	1
4) Not Applicable	6	4	12	22
5) No Response	<u>4</u>	<u>1</u>	<u>0</u>	<u>5</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
c. For your DBA, do you have the assurance that the monitoring system will not be subjected to adverse environmental factors that would affect its function?				
Yes	2	0	4	6
No	2	0	1	3
Not Applicable	5	4	7	16
No Response	<u>1</u>	<u>2</u>	<u>2</u>	<u>5</u>
Total Observations	10	6	14	30

6.8 Other Issues

a. Do you provide an environmental monitoring program, or does someone outside your company?				
Yes	8	3	8	19
No	0	0	0	0
Not Applicable	2	2	5	9
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
b. Do you have a QA program for the environs' liquid monitoring instrumentation?				
Yes	1	1	5	7
No	5	1	0	6
Not Applicable	4	3	7	14
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
c. How satisfied are you with your environmental liquid-monitoring emergency instrumentation?				
1) Very dissatisfied	0	0	0	0
2) Dissatisfied	0	0	0	0
3) Slightly dissatisfied	0	0	2	2
4) Neither dissatisfied nor satisfied	1	0	1	2
5) Slightly dissatisfied	0	0	0	0
6) Satisfied	0	0	2	2
7) Very satisfied	2	0	1	3
8) Not Applicable	5	4	7	16
9) No Response	<u>2</u>	<u>2</u>	<u>1</u>	<u>5</u>
Total Observations	10	6	14	30

d. Describe any plans you may have for changes or improvements in your environs liquid-monitoring instrumentation.

<u>Hazard-Potential Classification</u>	<u>Response</u>	<u>Number of Responses</u>
<u>High</u>		
1) Upgrades to: improve detection limits, institute automatic diversion capability on more streams, continual proportional sampling of all streams		1
2) Phase II line item will provide monitoring and diversion capability real-time continuous monitoring in construction. Phase III line item will provide monitoring to storage tanks.		2
3) Maintain state-of-the-art instrumentation for analysis		1
4) Investigating on-line tritium detection		1
5) Not Applicable		5
6) No Response		1
Total Observations		10
<u>Medium</u>		
1) Not Applicable		1
2) No Response		5
Total Observations		6
<u>Low</u>		
1) Upgrade program		1
2) Four composite water-sampling stations to be added on reviewing streams to replace grab-sampling program		1
3) Non Planned		4
4) Not Applicable		5
5) No Response		<u>3</u>
Total Observations		14

MODULE 7

PLANT EXHAUST AIR-MONITORING INSTRUMENTATION

	<u>High</u>	<u>Medium (a)</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
7.1 Sampling Methods				
a. Does the sampling system provide a sample that is proportional in volume to the exhaust flow under normal operating circumstances?				
Yes	9	7	6	22
No	1	1	6	8
Not Applicable	1	1	2	4
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	11	9	14	34
b. Does the system provide a sample that is proportional to the flow under conditions expected in an emergency?				
Yes	5	4	6	15
No	5	4	5	14
Not Applicable	1	1	3	5
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	11 ^(b)	9	14	34
c. Is the exhaust flow rate adjusted to automatically compensate for changing building loads?				
Yes	3	2	1	6
No	6	6	10	22
Not Applicable	1	1	3	5
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33

(a) One contractor site provided separate responses for each of four facilities at their sites. Thus for this module 9 applicable responses rather than the 6 used in other modules are reported for the medium-hazard category.

(b) One respondent reported "Yes" for ³H and "No" for Pu.

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
d. Under serious accident conditions, is it possible to release radionuclides through unfiltered exhausts?				
Yes	3	5	7	15
No	6	3	4	13
Not Applicable	1	1	3	5
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33

e. Gaseous and particulate effluents are monitored by:

1) <u>Both continuous detection and monitoring and by sampling and analysis.</u> Answer all questions under 7.2 and 7.3 below.	9	5	9	23
2) <u>Continuous detection and monitoring only.</u> Answer all questions under 7.2, SKIP questions under 7.3, and then go on to question 7.4.	0	2	1	3
3) <u>By sampling and analysis only.</u> SKIP questions under 7.2 and go on to questions under 7.3.	0	1	1	2
4) Not Applicable	<u>1</u>	<u>1</u>	<u>3</u>	<u>5</u>
Total Observations	10	9	14	33

7.2 Continuous Detection and Monitoring

a. What detection systems are used for gaseous effluent monitoring, and what are their ranges of response?

<u>Nuclide</u>	<u>System</u>	<u>Range ($\mu\text{Ci/cc}$)</u>
<u>High</u>		
1) ^{133}Xe	Stack	10^{-6} to 10^{-3}
^{131}I	Stack	10^{-8} to 10^{-5}
2) ^{85}Kr	All	10^{-7} to 10^{-3}

Nuclide	System	Range ($\mu\text{Ci/cc}$)
3) Mixed Activation Products	Ion Chamber	10^{-7} to 10^{-3}
Activated air	NMC	10^{-7} to 10^{-3}
Tritium	Ion Chambers	10^{-7} to 10^{-3}
4) ^{41}Ar	Remote - GeLi	5×10^{-9} to 2.5×10^{-5}
^{135}Xe	Remote - GeLi	5×10^{-9} to 2.5×10^{-5}
^{138}Xe	Remote - GeLi	5×10^{-9} to 2.5×10^{-5}
^{87}Kr	Remote - GeLi	5×10^{-9} to 2.5×10^{-5}
^{88}Kr	Remote - GeLi	5×10^{-9} to 2.5×10^{-5}
5) Tritium	Gas Bubblers	1×10^{-11} to Large quantities
Tritium	Kanne & Overhoff Ion Chambers	1.8×10^{-6} to 1×10^5
6) ^3H	Concentration-sensitive ion chamber	1×10^{-5} to 10
^3H	Integrating ion chamber	1 Ci/15 min to 900 + Ci/15 min
7) ^3H	Scintillation	2×10^{-13} to ----
^{85}Kr	Surface Barrier	1×10^{-6} to 1×10^{-1} (this upper limit could be higher)
^{129}I	LEPS	7×10^{-14} to ----
^{14}C	Scintillation	7×10^{-16} to ----
^{125}Sb	GeLi	1×10^{-13} to ----

^3H is collected on silica gel.

^{129}I is collected on charcoal.

^{14}C is collected on NaOH impingers.

^{125}Sb is collected on silver zeolite.

Nuclide	System	Range ($\mu\text{Ci/cc}$)
<u>Medium</u>		
1) ^{41}Ar	Ion Chamber	10^{-6} to 10^{-2}
^3H	Ion Chamber	10^{-5} to 10^{-2}
2) Radio Iodine	Charcoal air filters	10^{-15} to 10^6
Radio Xenon	Charcoal air filters	10^{-15} to 10^6
3) ^{85}Kr	G-M Tube	1.5×10^{-7} to 4.8×10^{-5}
^{125}Sb	Charcoal/ Scintillation	2.7×10^{-14} to 1.1×10^{-7}
4) ^{41}Ar	GM tube	4×10^{-8} to 4×10^{-4}
5) ^{85}Kr	GM tube	3×10^{-9} to 3×10^{-2}
^{125}Sb	Charcoal/NAI	N/A
^{133}Xe	NAI (+I)	10^{-6} to 10^{-2}
^{131}I	NAI (+I)	10^{-8} to 10^{-2}
Gross Gas	NAI (+I)	10^{-6} to 10^{-2}
6) ^3H	Conversion to ^3H to HTO and Absorption	5×10^{-13} to 19
^{85}Kr	Kanne Chamber	6×10^{-7} to 1×10^{-2}
^3H	Kanne Chamber	3×10^{-5} to 6×10^{-1}
<u>Low</u>		
1) Pu	Building	2×10^{-12} to 2×10^{-8}
2) Gross beta-gamma		50 c/m to 25 K c/m (not calibrated)
Gross alpha		50 c/m to 25 K c/m (not calibrated)

Nuclide	System	Range ($\mu\text{Ci/cc}$)
^{131}I		10^{-6} to no limit*
Inert gases		3.5×10^{-5} to 6.9×10^1
HFIR emergency gas monitor		to $10^6 \times \text{c/m}$ (not calibrated)
3) ^{99}Tc	Liquid Scintillation Counter	1.5×10^{-9} to 1×10^{-6}
4) Uranium	Ion Current Chamber	$\sim 10^{-9}$ to 2×10^{-8}
5) ^3H and ^3HTO	Ion Chambers	2m Ci/cc to 1 pCi/cc
^3H		to 25 Ci/cc
6) ^{131}I	Silver Silica gel	1.1×10^{-5} to range being checked
Noble gas calibrated as Xe	Cold Charcoal	1.1×10^{-5} Designed to handle DBA conditions
7) ^3H	Flow through Ion Chambers	10^{-6} to 1
8) ^{238}U	Space Recorder	
^{235}U	Space Recorder	
^{234}U	Space Recorder	

- b. What detection systems are used for airborne particulate effluent monitoring, and what are their ranges of response?

Nuclide	System	Range ($\mu\text{Ci/cc}$)
<u>High</u>		
1) ^{90}Sr	Area	10^{-11} to 10^{-8}
2) ^{90}Sr	All	10^{-8} to 10^{-2}

* Cartridge can be removed remotely for analysis.

Nuclide	System	Range ($\mu\text{Ci/cc}$)
<u>High</u>		
^{239}Pu	Combined	10^{-9} to 10^{-8}
3) ^{239}Pu	Eberline Alpha 4,5	2×10^{-12} in 4 hr to 10^{-8}
Gross beta-gamma	CAM	10^{-10}
4) Alpha	Eberline Alpha 3	up to 10,000 cts/min
5) ^{88}Rb	Stack Filter Tape	10^{-14} to 10^{-4}
^{89}Rb	Stack Filter Tape	10^{-14} to 10^{-4}
^{138}Cs	Stack Filter Tape	10^{-14} to 10^{-4}
6) ^{238}Pu	Discriminating Alpha air monitors	1×10^{-10} to 5×10^{-8}
^{238}Pu	Alpha Spectroscopy	1×10^{-17} to Large quantities
7) ^{239}Pu , ^{240}Pu	Selective Alpha Air Monitor	Time dependent
8) ^{239}Pu	Eberline Alpha 3 cam	8×10^{-12} to $\sim 10^{-8}$ assuming a 1 hour sample*
9) ^{137}Cs	Nal (tl)	The system will alarm at 700 cps
<u>Medium</u>		
1) Fission Products	Ion Chamber	1 mR/h to 1 R/h
Iodine-131	Single Channel (Nal)	10^{-8} to 10^{-5}
2) Fission Products	Whatman GF/A paper	10^{-15} to 10^6

* Cartridge may be removed remotely for analysis.

Nuclide	System	Range (μCi/cc)
<u>Medium</u>		
3) Any	Charcoal/GeLi	N/A
Any	Millipore/GeLi	N/A
4) Gross Alpha	ZnS Scintillation	6×10^{-12} to $1.5 \mu\text{Ci}$
^{137}Cs	NaI(±I)	5×10^{-9} to $14 \mu\text{Ci}$
Gross Part.		
Gamma	NaI(±I)	5×10^{-9} to $4.4 \mu\text{Ci}$
5) ^{238}Pu	Eberline Alpha 2	
6) U, Pu	Zn S(Ag)	4.3×10^{-13} to 1.5×10^{-9}
<u>Low</u>		
1) Gross beta-gamma		50 c/m to 25 K c/m (not calibrated)
Gross alpha		50 c/m to 25 K c/m (not calibrated)
^{131}I		10^{-6} to No limit*
Inert gases		3.5×10^{-5} to 6.9×10^1
HFIR emergency gas monitor		(unspecified) to 10^6 c/m (not calibrated)
2) U Isotopes	Chemical/Weight	5.4×10^{-9} to 2.2×10^{-4} @ 4.9% ^{235}U
3) N/A (β,γ)	Filter type/GM	Undergoing calibration and acceptance test
4) ^{238}U	Space Recorder	
^{235}U	Space Recorder	
^{234}U	Space Recorder	

* Cartridge may be removed remotely for analysis.

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
c. Can you relate the measured effluent concentrations ($\mu\text{Ci/ml}$) to a Ci/sec source term?				
Yes	9	7	7	23
No	0	0	1	1
Not Applicable	1	2	5	8
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	9	14	33
d. Would the response of your detectors be invalidated by foreseeable emergency conditions?				
Yes	4	3	5	12
No	5	4	3	12
Not Applicable	1	2	5	8
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	9	14	33

7.3 Sampling and Analysis

a. Is the sample air flow rate proportional to the discharge flow rate over the full range of discharge?				
Yes	5	5	7	17
No	5	1	4	10
Not Applicable	1	3	3	7
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	11 ^(b)	9	14	34
b. Are gases sampled?				
Yes	8	5	8	21
No	1	1	3	5
Not Applicable	1	3	3	7
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33

(b) One facility reported "Yes" for ^3H and "No" for Pu.

	High	Medium	Low	Total
	Number of Responses	Number of Responses	Number of Responses	Number of Responses
c. Are particulates sampled?				
Yes	8	5	11	24
No	1	1	1	3
Not Applicable	1	3	2	6
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33
d. Are particle size determinations made routinely?				
Yes	1	0	1	2
No	8	6	11	25
Not Applicable	1	3	2	6
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33
e. Is a spot sampling method used to augment data derived from the monitoring station?				
Yes	5	3	3	11
No	4	3	8	15
Not Applicable	1	3	3	7
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33
f. Identify the method				
1) Air Sample	2	0	0	2
2) Ground Level Sample	1	0	0	1
3) Charcoal, Paper Filter	0	0	1	1
4) Grab Samples	0	2	1	3
5) Spot Sample, Evacuation Control	0	1	0	1
6) Gas Bulb	1	0	1	2
7) Other	1	0	1	2
8) Not Applicable	<u>5</u>	<u>6</u>	<u>10</u>	<u>21</u>
Total Observations	10	9	14	33
g. Do you only monitor for gross radioactivity?				
Yes	3	1	3	7
No	6	5	7	18
Not Applicable	1	3	3	7
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	9	14	33

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
h. Is radioactivity computed back to initial concentration?				
Yes	6	3	5	14
No	3	3	5	11
Not Applicable	1	3	3	7
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	9	14	33
i. Can radionuclide concentrations in the sample be converted to ground depositions at various distances from the facilities?				
Yes	8	6	9	23
No	1	1	1	3
Not Applicable	1	2	3	6
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	9	14	33
j. What method of sampling is used?				
1) Filter paper	9	4	10	23
2) Charcoal	3	2	4	9
3) Solution	1	0	4	5
4) Other	5	2	3	10
5) Not Applicable	0	2	0	2
6) No Response	0	0	0	0

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

7.4 Accuracy and Reliability

- a. Is it permissible to deactivate the monitoring system without approval of your health physics staff?

Yes	1	0	4	5
No	8	8	6	22
Not Applicable	1	1	4	6
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33

- b. Is it permissible to deactivate the monitoring system without approval of your operations staff?

Yes	1	3	3	7
No	8	5	7	20
Not Applicable	1	1	4	6
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33

- c. Do you have back-up power to your gaseous-effluents-monitoring instruments?

Yes	8	6	7	21
No	1	1	2	4
Not Applicable	1	2	4	7
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	9	14	33

- d. How is the back-up power supply activated?

1) Automatically	8	5	7	20
2) Manually	1	1	0	2
3) Not Applicable	1	3	6	10
4) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	9	14	33

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
e. Are effluent monitors located to accurately and reliably measure the radioactivity in the effluents?				
Yes	7	8	9	24
No	2	0	1	3
Not Applicable	1	1	4	6
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33
f. For your DBA, do you have assurance that the monitoring system will not be subjected to adverse environmental factors that could affect its function?				
Yes	2	7	4	13
No	6	1	4	11
Not Applicable	2	1	6	9
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33
Please Explain.				
g. Is the exhaust air-monitoring system on a preventative maintenance schedule?				
Yes	8	7	6	19
No	1	1	4	6
Not Applicable	1	1	4	6
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33
h. What is the frequency?				
1) Monthly	3	2	1	6
2) Quarterly	3	1	3	7
3) Annually	3	0	1	4
4) Other	4	4	4	12
5) Not Applicable	2	2	8	12

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
i. How frequently is the monitoring system checked to assure that it is operational?				
1) Every shift	3	1	2	6
2) Daily	2	4	6	12
3) Weekly	4	2	3	9
4) Not at all	0	0	0	0
5) No Response	<u>1</u>	<u>2</u>	<u>3</u>	<u>6</u>
Total Observations	10	9	14	33
j. How often are the gaseous effluent monitor systems calibrated?				
1) Daily	1	0	1	2
2) Weekly	1	0	0	1
3) Monthly	1	0	2	3
4) Quarterly	3	5	2	10
5) Annually	2	1	4	7
6) Not at all	0	0	1	1
7) As needed	2	0	0	2
8) No Response	<u>0</u>	<u>3</u>	<u>4</u>	<u>7</u>
Total Observations	10	9	14	33
k. How are they calibrated?				
l. Would the radiation levels resulting from the design basis accident cause the monitoring location to be inaccessible?				
Yes	1	2	2	5
No	7	4	7	18
Not Applicable	1	3	4	8
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	9	14	33
m. Have provisions been made or are they being made to relocate readouts at locations that could be occupied?				
Yes	1	1	2	4
No	0	1	0	1
Not Applicable	9	7	12	28
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	9	14	33

MODULE 8

MONITORING OF RADIOACTIVE PARTICULATES AND GASES IN THE ENVIRONMENT

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
8.1 Monitoring of airborne radioactive effluents in the environment within the site boundaries				
1) Both continuous detection and monitoring and by sampling and analysis. Answer all questions under 8.2 and 8.3.	4	2	4	10
2) Continuous detection and monitoring only. Answer all questions under 8.2, SKIP questions under 8.3; then go on to questions under 8.4.	0	0	0	0
3) By sampling and analysis only. SKIP questions under 8.2 and go on to questions under 8.3	3	3	8	14
4) Not Applicable	<u>3</u>	<u>1</u>	<u>2</u>	<u>6</u>
Total Observations	10	6	14	30
8.2 Continuous detection and monitoring of airborne radionuclides in the environment				
a. Are gases monitored continuously?				
Yes	3	2	2	7
No	1	0	2	3
Not Applicable	<u>6</u>	<u>4</u>	<u>10</u>	<u>20</u>
Total Observations	10	6	14	30
b. Are particulates monitored continuously?				
Yes	2	2	4	8
No	2	0	0	2
Not Applicable	<u>6</u>	<u>4</u>	<u>10</u>	<u>20</u>
Total Observations	10	6	14	30

- c. If both gases and particulates are monitored what method is used to differentiate gaseous from particulate activity?

High

- 1) The sample is filtered. The particulate radioactivity is α emitters, the gaseous is β emitters
- 2) Filter paper for particulate, silica gel for HTO

Medium

- 1) A prefilter for particulates and a charcoal cartridge for non-inert gases
 - 2) Independent monitors
- d. What sample collection media is used to filter out the aerosol?

High

- 1) Millipore filter paper
- 2) Membrane filter
- 3) Whatman 41

Medium

- 1) Whatman glass filter paper
- 2) Millipore filter paper

Low

- 1) Activated charcoal cartridges, air filter papers and gum papers
 - 2) HEPA filter
 - 3) Charcoal impregnated filter
- e. What method is used to measure the concentration of particulate?

High

- 1) Gross α counting and alpha spectroscopy
- 2) Radiometric counting

- 3) We divided the measured activity by the measured air volume

Medium

- 1) Samples collected on Whatman GF/A glass filter paper and counted for gross beta and gamma spectrometry and taking into account the air volume
- 2) Gas proportional counter analysis of filter paper

Low

- 1) Autoradiographic techniques and specific radionuclide analyses (High-Resolution Gamma-ray Spectrometer)
- 2) Whatman 41

- f. Identify the detection and measuring system used for the radioactive gases.

High

- 1) Ion chambers which give gross activity readout
- 2) Kanne or Overhauf monitor and stack gas bubbler system
- 3) Distillation/counting of water from silica gel

Medium

- 1) Counting the charcoal cartridge, primarily for xenon and iodine, by gamma spectrometry
- 2) Beta scintillator and sodium iodide

Low

- 1) GM tube
- 3) Unshielded thin-window GM tubes
- 4) Alpha scintillation counter

- g. What is the range of response for gases?

High

- 1) 1×10^{-6} to 10^{-3} $\mu\text{Ci/cc}$

2) 1.8×10^{-6} to 1×10^5 $\mu\text{Ci/cc}$

3) minimum 2×10^{-11} $\mu\text{Ci/cc}$ HTO

Medium

1) 1×10^{-15} to 10^6 $\mu\text{Ci/cc}$

2) 1×10^{-11} to 10^{-6} $\mu\text{Ci/cc}$

h. What is the range of response for particulates?

High

1) 1×10^{-10} to 5×10^{-8} $\mu\text{Ci/cc}$

2) minimum 4×10^{-16} , α ; 5×10^{-15} , β

Medium

1) 1×10^{-15} to 1×10^6 $\mu\text{Ci/cc}$

2) 1×10^{-7} to 1×10^{-1} $\mu\text{Ci/cc}$

Low

1) 6.6×10^{-10} to 5×10^{-8} $\mu\text{Ci/cc}$

2) >0.2 dpm/ M^3

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

8.3 Analysis

a. Do you sample for gaseous radio-activity?

Yes	5	4	6	15
No	2	1	6	9
Not Applicable	<u>3</u>	<u>1</u>	<u>2</u>	<u>6</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
b. Do you sample for particulate radioactivity?				
Yes	7	5	11	23
No	0	0	1	1
Not Applicable	<u>3</u>	<u>1</u>	<u>2</u>	<u>6</u>
Total Observations	10	6	14	30
c. Do you have the capability to do particle size analysis?				
Yes	4	2	7	13
No	3	3	5	11
Not Applicable	<u>3</u>	<u>1</u>	<u>2</u>	<u>6</u>
Total Observations	10	6	14	30
d. Does the monitoring system provide the necessary information to permit the measured concentrations to be converted to ground deposition using meteorology data at various distances from the point of release?				
Yes	4	4	6	14
No	3	1	5	9
Not Applicable	3	1	2	6
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
e. Does the monitoring system communicate high and low trips in a continually manned location?				
Yes	1	1	1	3
No	6	4	9	19
Not Applicable	3	1	2	6
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30
f. Is the environmental monitoring system connected to an annunciator to indicate upscale responses in a manned location?				
Yes	2	0	0	2
No	5	5	10	20
Not Applicable	3	1	2	6
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
g. Is the environmental monitoring system connected to an annunciator to indicate zero responses in a manned location?				
Yes	0	0	0	0
No	7	5	10	22
Not Applicable	3	1	2	6
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30

- h. List the radionuclide associated with normal discharge and give percent composition by radionuclide.

High

- 1) Ar-41 (91%); Cs-138 (5%); Ze-135 (1%); Kr-87 (1%), KrRb-88 (<1%); Kr-85 m(<1%)
- 2) 99% of total activity discharged is beta and 1% is alpha; the predominant radionuclides are Strontium-90 and Plutonium-239 (Based on 1979 effluent data)
- 3) Tritium >99%, Plutonium-238 <1%
- 4) ^3H 99%
- 5) Pu-239, - 240 95%
- 6) ^{41}Ar (7%), ^3H (79)%, ^{13}N - ^{15}O (14 %) on a Curie basis
- 7) Pu-238, 239; Am-241, U-236, 234; Th-233, 234; I-131; Ar-41; P-32; H-3, C-11, N-13, O-15; Be-7

Medium

- 1) Ar-41 100% at research reactor site
H-3 100% at weapons R&D site
- 2) Gross fission products
- 3) ^{41}Ar , ^{85}Kr , ^3H (as HTO) Composition - variable
- 4) Xe-133 ~80%
- 5) Tritium 100%

Low

- 1) U, ^{131}I , ^{85}Kr , ^{133}Xe , ^{90}Sr , ^3H
 - 2) Uranium, approximately 50% and Tc-99, approximately 50% on a Curie Basis; total radionuclide concentration in effluent is in ppb
 - 3) Uranium
 - 4) Mixture of uranium isotopes (25%) and Tc-99 (75%) on total activity basis
 - 5) Noble Gases (97%), Particulates (2%) Others (H-3, C-14) (1%)
 - 6) ^{14}C (97%), ^{41}Ar (1%), ^{127}Xe (~1%), ^3H (gas - ~2%), ^3H (vapor - ~1%)
 - 7) Uranium % varies
 - 8) U-238; U-235; U-234; Uranium daughters, Technetium-99
 - 9) ^{35}S (50%) ^{85}Kr (50%)
- i. List the radionuclide expected by percent composition under accident conditions.

High

- 1) Noble gases (93%); Radionuclides (~7%)
- 2) Usually 100% H-3
- 3) Tritium > 99%, plutonium-238 < 1%
- 4) Pu-239 95%
- 5) Pu-239, 240 95%
- 6)

^{131}I	0.75	^{131}mXe	0.06
^{132}I	3.3	^{87}Kr	112.0
^{133}I	18.0	^{83}Kr	13.0
^{135}I	450.0	^{88}Kr	64.5
^{135}mXe	48.0	^{84}mKr	18.5
^{138}Xe	395.0	^{85}Kr	0.002
^{135}Xe	1050.0	^{244}Cm	0.024
^{133}mXe	36.0	^{239}Pu	0.000067
^{133}Xe	2.7		

Medium

- 1) 100% of noble gases, 25% of volatiles, and 10% of particulates from U-235 fission products at research reactor site; 100% H-3 at weapons R&D site
- 2) Gross fission products
- 3) Tritium 100%

Low

- 1) ^{131}I , ^{85}Kr , ^{133}Xe , ^3H , ^{60}Co , ^{90}Sr , ^{137}Cs
- 2) 100% Uranium - concentration of radionuclide in effluent steam would be dependent on specific accident and point where one measured the uranium content
- 3) ^{235}U > 90%
- 4) 100% soluble uranium
- 5) Varies according to facility type and accident conditions
- 6) ^{131}I - 2% ^{88}Kr - 1.3%
 ^{132}I - 4% $^{133\text{m}}\text{Xe}$ - 1%
 ^{133}I - 4% ^{133}Xe - 45%
 ^{135}I - 2% $^{135\text{m}}\text{Xe}$ - 4%
 $^{85\text{m}}\text{Kr}$ - 1.5% ^{135}Xe - 35%
- 7) A vast array of nuclides - most in rather small quantities μCi mCi range and kCi of ^3H
- 8) Pure uranium compound
- 9) Could be any of a number of F.A.'s, TRU's or medical isotopes

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

j. What is the time lapse between sampling and analysis? ____ hours.

1) 1 hr or less	2	0	2	4
2) 2 to 8 hr	2	2	2	6
3) 9 to 24 hr	0	1	1	2
4) 25 to 48 hr	0	0	0	0
5) 49 to 96 hr	1	0	4	5
6) 97 to 120 hr	0	0	0	0

	High	Medium	Low	Total
	Number of Responses	Number of Responses	Number of Responses	Number of Responses
7) >120 hr	1	2	2	5
8) Not Applicable	3	1	2	6
9) No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

- k. Is a procedure available which permits estimating the noble gases present from other data?

Yes	1	3	2	6
No	6	2	9	17
Not Applicable	3	1	2	6
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

8.4 Calibration and Reliability of Environmental Monitoring Systems

- a. Is it permissible to deactivate the system without the approval of the plant manager?

Yes	4	2	5	11
No	3	2	4	9
Not Applicable	3	1	2	6
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

- b. Does the environmental-monitoring system function when grid power fails?

Yes	4	2	2	8
No	3	2	8	13
Not Applicable	3	1	2	6
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

- c. For your DBA, do you have the assurance that the monitoring system will not be subjected to adverse environmental factors that would affect its functions?

Yes	1	2	4	7
No	5	1	5	11
Not Applicable	3	1	2	6
No Response	<u>1</u>	<u>2</u>	<u>3</u>	<u>6</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
d. How often is the environmental system given a functional check?				
1) Daily	1	0	1	2
2) Weekly	4	2	7	13
3) Monthly	2	0	2	4
4) Quarterly	0	1	0	1
5) Annually	0	0	0	0
6) Not at all	0	1	0	1
7) Not Applicable	3	1	2	6
8) No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
e. How often is the electronic measuring system calibrated?				
1) Daily	2	1	1	4
2) Weekly	1	0	2	3
3) Monthly	0	0	0	0
4) Quarterly	1	1	2	4
5) Annually	2	0	2	4
6) Not at all	1	2	1	4
7) Not Applicable	3	1	2	6
8) No Response	<u>0</u>	<u>1</u>	<u>4</u>	<u>5</u>
Total Observations	10	6	14	30
f. How often is the flow measuring system calibrated?				
1) Daily	0	0	1	1
2) Weekly	0	1	1	2
3) Monthly	1	0	2	3
4) Quarterly	2	1	3	6
5) Annually	2	1	3	6
6) Not at all	2	1	0	3
7) Not Applicable	3	1	2	6
8) No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
g. What provisions are made to prevent fallout build-up on the monitoring system?				
1) Shelter, position	2	2	1	5
2) Clean and replace filters	1	1	4	6
3) None	3	1	3	7
4) Not Applicable	3	1	2	6
5) No Response	<u>1</u>	<u>1</u>	<u>4</u>	<u>6</u>
Total Observations	10	6	14	30

MODULE 9

MONITORING RADIATION DOSE LEVELS IN THE ENVIRONMENT

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

9.1 Method of Monitoring

a. Dose rates in the environment are measured:

1) Never	0	0	2	2
2) Daily	0	0	1	1
3) Weekly	0	0	1	1
4) Monthly	1	0	3	4
5) Quarterly	2	2	2	6
6) Annually	3	0	1	4
7) Continually	1	3	1	5
8) Not Applicable	3	1	3	7
9) No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

b. Is the beta contribution to the dose rate monitored?

Yes	2	2	4	8
No	5	2	7	14
Not Applicable	3	1	3	7
No Response	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

c. Is the gamma contribution to the dose rate monitored?

Yes	5	4	10	19
No	2	1	1	4
Not Applicable	3	1	3	7
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

If both gamma and beta contributions are separately monitored, what method is used to differentiate between them?

1) B shielded lead cylinder	0	0	0	0
2) Sample counting	0	0	1	1
3) Filters over TLD	1	1	0	2

	High	Medium	Low	Total
	Number of Responses	Number of Responses	Number of Responses	Number of Responses
4) Gamma monitored by ion chamber	0	0	0	0
5) G.M. Probe	0	0	1	1
6) TLD chips	1	0	0	1
7) Not Applicable	5	3	7	15
8) No Response	<u>3</u>	<u>2</u>	<u>5</u>	<u>10</u>
Total Observations	10	6	14	30

d. What method of dose measurement is used? (Check all that apply.)

1) GM Tube				
a) 1×10^{-2} to 1×10^2 mrad/hr	0	0	2	2
b) 5×10^{-4} to 5×10^2 mrad/hr	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	0	0	3	3
2) Ionization Chamber				
a) 1×10^{-1} to 1×10^6 mrad/hr	1	0	1	2
b) 1×10^{-3} to 5×10^{-1} mrad/hr	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>
Total Observations	1	1	1	3
3) Scintillation Crystal				
a) 3×10^{-3} to 3×10^0 mrad/hr	0	0	1	1
b) Bkgd. to 1.5×10^{-1} mrad/hr	0	0	1	1
c) 1 to 1.5×10^2 mrad/hr	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	0	0	3	3
4) Proportional Chamber				
a) 8×10^{-3} to 5×10^1 mrad/hr	0	0	1	1
b) 5×10^{-5} to 1×10^4 mrad/hr	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	0	0	2	2
5) Thermoluminescence Dosimeter				
a) 2×10^{-3} to 5.0×10^1 mrad/hr	1	0	0	1
b) 1×10^1 to 1×10^4 mrad/hr	0	0	1	1
c) 2×10^1 to 3×10^5 mrad/hr	0	0	1	1
d) 1×10^{-2} to 5×10^{-2} mrad/hr	0	0	0	0
e) 6×10^{-3} to 1×10^8 mrad/hr	0	0	1	1
f) 1×10^{-2} to 1×10^3 mrad/hr	1	0	1	2
g) 1×10^{-3} to 1×10^2 mrad/hr	0	1	0	1
h) 6×10^{-3} to 5×10^3 mrad/hr	0	1	0	1
i) 1×10^{-3} to ---- mrad/hr	0	0	2	2

	High	Medium	Low	Total
	Number of Responses	Number of Responses	Number of Responses	Number of Responses
j) 2×10^{-2} to 1 mrad/hr	0	1	1	2
k) 1×10^2 to 1×10^3 R/hr	0	0	1	1
l) μ R/h to >100 mrad/hr	1	0	0	1
m) 1×10^2 to >1 mrad/hr	0	0	0	0
n) 10 mrem/3 months	1	0	0	1
o) No Response	<u>1</u>	<u>1</u>	<u>2</u>	<u>4</u>
Total Observations	5	4	10	19

6) Other

a) RAMS - Pressurized Ion Chamber 0.1 to 10^7 mrad/hr	0	1	0	1
b) Calculated via pathway analyses based on effluent samples and dispersion models.	0	0	1	1
c) Track etch 1 mrem/3 months	1	0	0	1

9.2 Calibration and Reliability

a. How often are the dose-rate-monitoring systems calibrated?

1) Daily	0	0	0	0
2) Weekly	0	0	2	2
3) Monthly	1	0	2	3
4) Quarterly	2	3	3	8
5) Annually	1	0	3	4
6) Not at all	0	1	1	2
7) Not Applicable	3	1	3	7
8) No Response	<u>3</u>	<u>1</u>	<u>0</u>	<u>4</u>
Total Observations	10	6	14	30

b. What radioactive sources are used for calibration?

1) Cs-137	4	1	5	10
2) Radium-226 Source	0	1	2	3
3) Radium	0	0	1	1
4) ^{60}Co	2	1	3	6
5) Uranium, plate	0	1	0	1
6) ^{238}U	0	0	1	1
7) $^{239}\text{PuBe}$	0	0	1	1
8) Done by commercial service	0	0	1	1

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
9) ^{252}Cf	1	0	0	1
10) $\alpha\text{-N}$ Sources	1	0	0	1
11) Not Applicable	3	1	3	7
12) No Response	3	1	0	4
c. How often are the dose-rate-monitoring systems checked for operational capability?				
1) Daily	0	0	3	3
2) Weekly	0	2	1	3
3) Monthly	1	1	2	4
4) Other	2	1	2	5
5) Not Applicable	3	1	3	4
6) No Response	<u>4</u>	<u>1</u>	<u>3</u>	<u>8</u>
Total Observations	10	6	14	30
d. Have dose rate-monitoring-instruments been located in positions where accuracy and reliability can be achieved?				
Yes	3	5	8	16
No	1	0	3	4
Not Applicable	5	1	3	9
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
e. Is the monitoring system connected to process alarms?				
Yes	1	1	2	4
No	2	4	8	14
Not Applicable	3	1	3	7
No Response	<u>4</u>	<u>0</u>	<u>1</u>	<u>5</u>
Total Observations	10	6	14	30
f. Do you have a back-up power supply?				
Yes	1	2	2	5
No	1	2	7	10
Not Applicable	3	1	3	7
No Response	<u>5</u>	<u>1</u>	<u>2</u>	<u>8</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

How is it activated?

1) Manually	0	2	0	2
2) Automatically	1	0	2	3
Not Applicable	4	3	10	17
No Response	<u>5</u>	<u>1</u>	<u>2</u>	<u>8</u>
Total Observations	10	6	14	30

g. Is it permissible to deactivate the monitoring system without approval of your health physics staff?

Yes	1	3	3	7
No	1	2	7	10
Not Applicable	3	1	3	7
No Response	<u>5</u>	<u>0</u>	<u>1</u>	<u>6</u>
Total Observations	10	6	14	30

MODULE 10

MONITORING OF CONTAMINATION LEVELS IN THE ENVIRONMENT

10.1 Method of Monitoring

a. What direct measurements are made to determine deposited contamination?

High

- 1) μ R meter and GM probe readings of grid within the site boundary
- 2) Beta-gamma detection
- 3) Alpha, beta, gamma, low energy x-ray
- 4) Some γ measurements from deposition of plutonium-238
- 5) Fidler - gamma instrument for the detection of low level radiation and
Ludlum - alpha instrument

Medium

- 1) Exposure dose and gamma spectrometry
- 2) Direct reading taken with portable survey instruments - usually thin window gas proportional type
- 3) Radiation survey

Low

- 1) Portable instrument surveys
- 2) Fallout particle monitor G.M. counter - telemeter to central station
- 3) Surface alpha and beta-gamma with portable survey meters
- 4) Outside air sampler and dust falls
- 5) Ge(Li) spectroscopy, In-situ gamma spectroscopy analysis of environmental samples;
exposure rate surveys
- 6) High pressure ion-chamber
- 7) Soil and vegetation sampling, collection pans
- 8) Radiochemical analysis

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
b. What media are collected?				
1) Soil	7	5	9	21
2) Vegetation	7	4	10	21
3) Milk	2	2	6	10
4) Surface water	6	4	8	18
5) Potable water	5	4	8	17
6) Others:				
a) Animal feces	1	0	0	1
b) Waterway sediments	1	2	1	4
c) Wildlife specimens	0	0	3	3
d) Water vapor, precipitation	1	0	0	1
e) Air, air particulate	1	1	0	2
f) Well water and spring water	0	1	0	1
g) Subsurface water	0	0	2	2
h) Crops	1	0	0	1
7) Not Applicable	3	1	3	7

c. What field measurements are made on the samples collected?

High

- 1) GM count or survey
- 2) Beta-gamma surveys with a field dose rate instrument
- 3) Low energy x-ray, gamma associated with alpha decay, alpha, beta
- 4) Mostly physical measurements for future analytical analysis
- 5) Suspected contaminated samples are screened for both alpha and gamma

Medium

- 1) Gamma rate
- 2) Direct reading with portable survey instruments

Low

- 1) GM count or survey
- 2) Gross beta-gamma and gross alpha
- 3) Rain depth

d. What instruments are used in making the field measurements in the field?

High

- 1) P-11 probe, μ R meter
- 2) Eberline dose rate instruments
- 3) Phoswich, μ R meter, GM meter, alpha meter
- 4) Some γ measurements from deposition of plutonium-238
- 5) Fidler (gamma) Ludlum (alpha)

Medium

- 1) Ion chambers, GM counters and scintillators
- 2) Thin window gas proportional survey meter. Thin NaI scintillation counter
- 8) Survey meter with HP-210 probe (Eberline)

Low

- 2) GM
- 4) Cutie Pie, GSM, alpha meter, NaI survey meter, gamma spectrometer system

e. What is the range of response of detectors used for d., above?

High

- 1) 0 to 5×10^4 mrad/hr
- 2) 1×10^{-2} to 1×10^2 mrad/hr
- 3) 5×10^{-1} to 5×10^3 mrad/hr

Medium

- 1) 6×10^{-3} to 1×10^3 mrad/hr
- 2) 0 to 200 mrad/hr

Low

- 1) 1×10^{-2} to 1×10^5 mrad/hr

10.2 Analysis

- a. In your laboratory analysis of environmental samples, check the following radionuclides that are normally identified in your analysis.

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
1) Iodine-131	1	2	3	6
2) Strontium-90	4	1	5	10
3) Cesium-137	5	4	6	15
4) Ruthenium-102, 106	2	2	2	6
5) Uranium	6	2	8	16
6) Plutonium	6	5	5	16
7) Others:				
a) H-3	4	2	2	8
b) Am-241	1	0	2	3
c) gross α	1	0	0	1
d) gross β	1	1	0	2
e) Mn-54	1	0	0	1
f) Co-60	1	0	1	2
g) Fe-59	1	0	0	1
h) Ce-144	1	1	1	3
i) Fission Products	0	1	0	1
j) Trans-plutonium elements	0	1	0	1
k) Entire gamma spectrum	1	0	1	2
l) Tc-99	0	0	3	3
m) Np-237	0	0	2	2
n) Curium	0	0	1	1
o) Not Applicable	2	0	0	2
p) No Response	1	1	3	4

- b. Is radioactivity computed to collection time?

Yes	2	3	6	11
No	5	2	5	12
Not Applicable	2	0	0	2
No Response	<u>1</u>	<u>1</u>	<u>3</u>	<u>5</u>
Total Observations	10	6	14	30

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>

10.3 Accuracy and Reliability

- a. For your DBA, do you have the assurance that the monitoring system will not be subjected to adverse environmental factors that would affect its function?

Yes	3	2	5	10
No	1	1	2	4
Not Applicable	5	1	2	8
No Response	<u>1</u>	<u>2</u>	<u>5</u>	<u>8</u>
Total Observations	10	6	14	30

- b. Has contamination level monitoring been performed in positions where optimum accuracy and reliability can be achieved?

Yes	4	4	7	15
No	1	0	2	3
Not Applicable	2	0	1	3
No Response	<u>3</u>	<u>2</u>	<u>4</u>	<u>9</u>
Total Observations	10	6	14	30

- c. How often is the contamination-level-monitoring system calibrated?

1) Semi-annually	1	2	0	3
2) Daily	0	0	4	4
3) Weekly	1	1	1	3
4) Monthly	1	1	0	2
5) Quarterly	1	0	2	3
6) Annually	0	1	0	1
7) Not at all	1	0	1	2
8) Not Applicable	5	1	4	10
9) No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
d. What radioactivity sources are used for calibration? (note: 13 sites responded to question, most listed more than 1 source)				
1) Mixed radionuclide source (Co-60, Mn-54, Cs-137, Ce-144)	2	0	0	1
2) Sr-90	1	0	3	4
3) Np-237	0	0	1	1
4) Pu-238	0	0	3	3
5) Tc-99	0	0	1	1
6) Pu-239	1	2	3	6
7) Cs-137	0	3	1	4
8) U-238	0	1	3	4
9) Gd-148	0	1	0	1
10) Eu-152	0	1	0	1
11) H-3	0	1	1	2
12) Co-60	0	0	1	1
13) Ce-144	0	0	2	2
14) C-14	0	0	1	1
15) Am-241	0	0	2	2
16) Cl-36	0	0	1	1
17) Cs-134	0	0	1	1
18) Cm-244	0	0	1	1
19) Pm-147	0	0	1	1
20) Ra-226	0	0	1	1
21) None	0	0	1	1
22) Not Applicable	2	1	0	3
23) No Response	3	2	6	1
e. Upon recalibration, what percentage of the time do the instruments require calibration adjustments?				
1) 0	0	0	1	1
2) 1%	1	0	0	1
3) 5%	0	1	1	2
4) 10%	1	1	1	3
5) 25%	0	1	0	1
6) 50%	1	0	1	2
7) Not Applicable	6	1	6	13
8) No Response	<u>1</u>	<u>2</u>	<u>4</u>	<u>7</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
f. Other than c. above, how often is the monitoring system checked to assure that it is operational?				
1) Every shift	0	1	2	3
2) Daily	3	0	3	6
3) Weekly	1	1	0	2
4) Not at all	1	1	1	3
5) Not Applicable	4	1	1	6
6) No Response	<u>1</u>	<u>2</u>	<u>7</u>	<u>10</u>
Total Observations	10	6	14	30

10.4 Physical Properties

- a. If commercially available instruments are used, give the manufacturer's name and model number.

High

- 1) Ludlum μ R meter Model 125; PGT GeLi Detector, Model LGC 14SD; PGT GeLi Detector, model LGC 14NPR
- 2) Eberline
- 3) Ludlum Model 43-1, Ludlum Model 19, Ludlum Model 14C, Eberline Model PRM-5, Ludlum Model 2200
- 4) Radeco 442A for plutonium-238, Arcas Keithly 2600 for tritium
- 5) Too numerous for direct measurement probes; Rocky Flats designed particulate samplers

Medium

- 1) Searle Mark III, Nuclear Chicago C-210, Tennelec LB 5100, Princeton Gamma Tech
- 2) Eberline EI40, E520, Ludlum Model 19
- 3) Eberline PAC 4G-J, Eberline PRM 5-3, PG 2 Probe
- 4) Nuclear Measurements Corp PC-4 proportional counter, Ludlum GM with HP-210 probe, Johnson survey meter with DP-3 alpha probe.

Low

- 1) Eberline EGM
- 2) Ludlum Model 2 and Model 12; Eberline Model E120; ORNL Cutie Pie; Northern Econ II Series Model 720; Packard Tri-carb Liquid Scintillation spectrometer Models 574 and 3003
- 3) Built by DOE contractor
- 4) Ge(Li) spectrometers, Ludlum Micro R meter, Alpha Spectrometers, HP-210 probe with RM-14 Rate meter, thin-window GM
- 5) TLD 200 Harshaw Chemical Co
- 6) Several scalers with associated probes are used for ambient radiation monitoring; the equipment is manufactured by Ludlum and Eberline

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

- b. What are the anticipated radiation levels for the DBA at positions where the monitoring readouts are located?

1) 5×10^{-3} mR/hr	0	1	1	2
2) 5 mR/h	1	0	0	1
3) <2 mR/hr	1	0	1	2
4) 1-100 mR/hr	0	1	0	1
5) 1×10^4 mR/hr	0	1	0	1
6) Not Applicable	7	2	4	13
7) No Response	<u>1</u>	<u>1</u>	<u>8</u>	<u>10</u>
Total Observations	10	6	14	30

- c. Is it anticipated that the radiation levels described in b. would pose a significant hazard to personnel at those locations?

Yes	1	1	0	2
No	3	2	5	10
Not Applicable	5	2	3	10
No Response	<u>1</u>	<u>1</u>	<u>5</u>	<u>8</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
d. Have provisions been made or are they being made to relocate readouts at locations that could be occupied?				
Yes	1	1	2	4
No	3	2	3	8
Not Applicable	5	2	4	11
No Response	<u>7</u>	<u>1</u>	<u>5</u>	<u>7</u>
Total Observations	10	6	14	30

10.5 Other Issues

a. Does your company have its own environmental monitoring program?				
Yes	7	5	11	23
No	0	0	0	0
Not Applicable	2	0	0	2
No Response	<u>1</u>	<u>1</u>	<u>3</u>	<u>5</u>
Total Observations	10	6	14	30
b. Does someone outside your company provide your environmental program?				
Yes	2	1	1	4
No	5	4	10	19
Not Applicable	2	0	0	2
No Response	<u>1</u>	<u>1</u>	<u>3</u>	<u>5</u>
Total Observations	10	6	14	30
c. Are the measurements of the outside organization to be used in your emergency situation assessment?				
Yes	1	1	1	3
No	4	1	7	12
Not Applicable	4	3	1	8
No Response	<u>1</u>	<u>1</u>	<u>5</u>	<u>7</u>
Total Observations	10	6	14	30
d. How satisfied are you with your contamination level emergency instrumentation?				
1) Very dissatisfied	0	0	0	0
2) Dissatisfied	0	0	0	0
3) Slightly dissatisfied	1	0	2	3
4) Neither dissatisfied nor satisfied	0	0	1	1

	High	Medium	Low	Total
	Number of Responses	Number of Responses	Number of Responses	Number of Responses
5) Slightly satisfied	0	0	1	1
6) Satisfied	4	3	2	9
7) Very satisfied	1	2	3	6
8) Not Applicable	3	0	0	3
9) No Response	<u>1</u>	<u>1</u>	<u>5</u>	<u>7</u>
Total Observations	10	6	14	30

- e. Describe any plans you may have for changes or improvements in your contamination level emergency instrumentation.

1) None	2	4	4	10
2) Planer Systems	1	0	0	1
3) Projects line item	0	0	1	1
4) Air monitoring upgrade	0	1	3	4
5) Surface H-3	0	0	1	1
6) Offsite monitor	0	0	1	1
7) Replace with newer	2	0	0	2
8) Not Applicable	2	0	0	2
9) No Response	<u>3</u>	<u>1</u>	<u>4</u>	<u>8</u>
Total Observations	10	6	14	30

- f. Is calibrated and tested aerial survey instrumentation available?

Yes	2	4	3	9
No	5	1	8	14
Not Applicable	2	0	0	2
No Response	<u>1</u>	<u>1</u>	<u>3</u>	<u>5</u>
Total Observations	10	6	14	30

- g. What is the estimated time to commence an emergency aerial survey (i.e., to get monitoring equipment airborne)?

1) 2 hr	1	1	1	3
2) 4 hr	0	0	0	0
3) 6 hr	0	1	1	2
4) 24 hr	0	1	1	2
5) Not Applicable	4	1	1	6
6) No Response	<u>5</u>	<u>2</u>	<u>10</u>	<u>17</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
h. What is the estimated time, once air-borne, to obtain initial analysis of ground level concentrations?				
1) 1 hr	0	0	2	2
2) 3 hr	0	1	0	1
3) 4 hr	1	0	0	1
4) 12 hr	0	1	0	1
5) 24 hr	0	0	1	1
6) Not Applicable	5	2	2	9
7) No Response	<u>4</u>	<u>2</u>	<u>9</u>	<u>15</u>
Total Observations	10	6	14	30
i. How do you relate your aerial survey results to ground concentration levels?				
1) Not done	0	0	1	1
2) Done by others	0	1	2	3
3) Computer simulation	0	1	0	1
4) Soil samples	1	0	0	1
5) Not Applicable	5	2	3	10
6) No Response	<u>4</u>	<u>2</u>	<u>8</u>	<u>14</u>
Total Observations	10	6	14	30

MODULE 11

METEOROLOGY STATION INSTRUMENTATION

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

11.1 Method of Monitoring

- a. Do you provide a meteorological monitoring program? If no, skip the balance of this module.

Yes	4	3	8	15
No	<u>6</u>	<u>3</u>	<u>6</u>	<u>15</u>
Total Observations	10	6	14	30

- b. What measurements are taken?
Check all that apply.

Horizontal wind direction.

Yes	4	3	8	15
No	0	0	0	0
Not Applicable	<u>6</u>	<u>3</u>	<u>6</u>	<u>15</u>
Total Observations	10	6	14	30

Threshold value:

1) <1°	1	0	0	1
2) 75mph	1	0	2	3
3) 2mph	0	0	1	1
4) 10°	0	1	0	1
5) 0.8°	0	0	0	0
6) 1.0°	0	1	0	1
7) 2.0°	0	0	1	1
8) 3.0°	0	0	1	1
9) 5.0°	0	1	0	1
10) continuous measurement	1	0	0	1
11) Not Applicable	6	3	6	15
12) No Response	<u>1</u>	<u>0</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

Vertical wind direction.

Yes	2	0	1	3
No	2	3	7	12
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
Threshold value (None specified)				
Not Applicable	8	6	13	27
No Response	<u>2</u>	<u>0</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30
Horizontal wind speed.				
Yes	4	3	8	15
No	0	0	0	0
Not Applicable	<u>6</u>	<u>3</u>	<u>6</u>	<u>15</u>
Total Observations	10	6	14	30
Threshold value:				
1) 0.4 m/sec	0	1	0	1
2) 0.1 m/sec	1	0	0	1
3) 1 m/sec	1	0	1	1
4) <1 m/sec	0	0	1	1
5) 0.5 mile/hr	1	0	0	1
6) 0.6 mile/hr	0	0	2	2
7) 0.75 mile/hr	0	1	0	1
8) 1.0 mile/hr	1	0	2	3
9) 2.0 mile/hr	0	1	0	1
10) Not Applicable	6	3	6	15
11) No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30
Vertical wind speed.				
Yes	2	0	2	4
No	2	3	6	11
Not Applicable	<u>6</u>	<u>3</u>	<u>6</u>	<u>15</u>
Total Observation	10	6	14	30
Threshold value:				
1) <0.75 mile/hr	0	0	1	1
2) 0.1 m/sec	1	0	0	1
3) 1.0 m/sec	1	0	0	1
4) Not Applicable	8	6	12	26
5) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
c. Are the measurements averaged?				
Yes	4	2	6	12
No	0	1	2	3
Not Applicable	<u>6</u>	<u>3</u>	<u>6</u>	<u>15</u>
Total Observations	10	6	14	30

- d. List the elevations above sea level that temperatures are measured.

High (6 Not Applicable)

- 1) 6687', 7380'
- 2) 1,042', 986', 880'
- 3) 6020', 6200'
- 4) 199 meter, 222 meter

Medium (3 Not Applicable)

- 1) 229.1m, 235.1m
- 2) 10m, 70m
- 3) Not measured

Low (6 Not Applicable, 2 No Response)

- 1) 736', 753', 783', 833', 933', 983', 1033', 1133'
- 2) 388'
- 3) 131, 141, 151m
- 4) 4970', 5180'
- 5) 95'
- 6) 670'

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
e. Do you use a real time computer system to perform meteorology calculations?				
Yes	3	1	2	6
No	1	2	5	8
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
If no, SKIP to question j.				
f. Can the atmosphere stability be determined by the wind velocity and direction measured?				
Yes	1	0	0	1
No	2	1	1	4
Not Applicable	7	5	11	23
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30
g. Are you able to compute cloud dispersion and ground deposition?				
Yes	3	1	1	5
No	0	0	1	1
Not Applicable	7	5	11	23
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
h. Does the exhaust air monitoring system provide the necessary information to permit source terms to be fed into the computer for noble gases?				
Yes	1	1	1	3
No	2	0	1	3
Not Applicable	7	5	11	23
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
i. Does the exhaust air-monitoring system provide the necessary information to permit a source term to be fed into the computer for particulates?				
Yes	2	1	2	5
No	1	0	0	1
Not Applicable	1	5	10	22
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30
j. Are you prepared to perform air monitoring with helicopters or airplanes?				
Yes	0	1	2	3
No	4	2	5	11
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
k. Are there permanent monitoring stations that can transmit concentration measurements to a central station?				
Yes	0	1	1	2
No	4	2	6	12
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
l. How do you plan to predict plume travel of any gaseous release?				

High

- 1) Use simple Gaussian dispersion program using meteorological information at workplace
- 2) Gaussian plume and atmospheric release advisory capability (ARAC)
- 3) Use ARAC system capabilities
- 4) Use ARAC

Medium

- 1) Hand calculation, Gaussian plume models, by research staff diverted for emergencies
- 2) Through a contractor mesonet wind network and radar tetron trajectories
- 3) Use aerovane data

Low

- 1) Using a mesoscale Transport and diffusion computer model
- 2) Tables and graphic plotting
- 3) Mesonet windfield measurements and tetrons
- 4) Using nomograms and contractor atmospheric stability categories
- 5) Dispersion modeling using data manually obtained from meteorology instrumentation
- 6) Atmospheric modeline

11.2 Analyses

- a. What methods of readout are used, and
- b. Where are the readouts reported?

Combined Results

High

- 1) Area "Y" site - LCD, Area "X" site - LCD; strip chart at both sites record 15-minute averages on cassette tape
- 2) ANALOG recorder, digital meter, video screen and hard copy for 15-minutes averages; reported to ARAC site facility
- 3) CRT, printer; reported to building housing environmental and health physics personnel
- 4) Strip chart and computer; reported to ARAC central and LLNL Fire Department

Medium

- 1) Micromet data: charts, digital printout of averages, digital cassette tape, computer-graphics for monthly summaries; archived at meteorology station; solar radiation and precipitation for NOAA climatological record
- 2) Computers and plots; reported to emergency room

- 3) Strip chart recorder of wind speed and direction; reported on recorder inside plant

Low

- 1) For met systems - both analog and digital located at Building "X"
- 2) Charts and computer tape; reported to plant superintendent's office
- 3) Meter indications and strip chart recorders; reported to plant control facility
- 4) Computer; reported to operator's room, and warning communications center
- 5) Chart, digitals in meteorology bldg
- 6) Strip chart in Environmental, Health, and Safety Building EH&S
- 7) Strip charts at meteorological station

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
c. Are the readouts shown continuously at a constantly manned location?				
Yes	1	1	4	6
No	3	2	3	8
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
d. Are some of your facility operating procedures dependent on the meteorological observations?				
Yes	2	2	4	8
No	2	1	3	6
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

What?

High

- 1) Explosive shots, taxi service at airport (high crosswinds which prevent landings and takeoffs)

2) Tritium handling restricted in rain

Medium

1) Occasional venting of hydrogen

2) Treat reactor transient operations

Low

1) Some waste-handling operations cannot be performed under wind conditions exceeding 15 mph

2) SO₂ monitoring system

3) "X" reactor

4) Gas venting from selected operations

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
e. Are your analyses computerized?				
Yes	4	2	5	11
Some	0	0	1	1
No	0	1	1	2
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
f. Is your staff capable of making and interpreting dispersion and deposition and calculations?				
Yes	4	2	5	11
No	0	0	0	0
Not Applicable	6	4	7	17
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30
g. What methods do they use? Check all that apply.				
1) Model	4	2	6	12
2) Deposition Velocity	2	2	2	6
3) Ranout Factors	2	1	1	4

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>

11.3 Accuracy and Reliability

a. How often are the meteorological instruments calibrated?

1) Annually	1	0	1	2
2) Biennially	1	0	0	1
3) Quarterly	2	0	3	5
4) Rarely	0	0	1	1
5) Infrequently	0	0	1	1
6) Randomly	0	0	1	1
7) Not Applicable	6	3	6	15
8) No Response	<u>0</u>	<u>3</u>	<u>1</u>	<u>4</u>
Total Observations	10	6	14	30

b. How often is the meteorological-monitoring system checked for operational capability?

1) Weekly	0	0	3	3
2) Quarterly	0	1	0	1
3) Daily	1	0	3	4
4) Continuous	2	2	1	5
5) Bimonthly	1	0	0	1
6) Not Applicable	6	3	6	15
7) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

c. Have meteorological stations been located in positions where optimum accuracy and reliability can be achieved?

Yes	4	2	5	11
No	0	1	2	3
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

d. For your DBA, will the monitoring system be subjected to environmental factors that would affect its performance?

Yes	0	0	1	1
No	4	2	2	8
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>1</u>	<u>5</u>	<u>6</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
Explain:				
1) Location causes bias	0	0	1	1
e. Do you have a back-up power supply?				
Yes	2	3	5	10
No	2	0	2	4
Not Applicable	6	3	6	15
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
f. How is back-up power provided?				
1) Automatically	1	3	3	7
2) Manually	0	0	1	1
Not Applicable	8	3	8	19
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

MODULE 12

COMMUNICATION ARRANGEMENTS

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
12.1 What communication equipment is immediately available for use? Check all that apply.				
a. Walkie-talkie				
Yes	8	6	14	28
No	0	0	0	0
Not Applicable	2	0	0	2
If yes, how many?				
1) 0	0	0	5	5
2) 8	0	0	1	1
3) 9	1	0	0	1
4) 15	2	0	0	2
5) 19	0	2	0	2
6) 24	0	1	0	1
7) 30	0	1	2	3
8) 40	0	0	1	1
9) 50	1	0	0	1
10) 60	1	1	1	3
11) 90	0	1	0	1
12) 100	0	0	1	1
13) 125	1	0	0	1
14) 130	0	0	1	1
15) 247	0	0	1	1
16) 338	0	0	1	1
17) 355	1	0	0	1
18) Unspecified	1	0	0	1
19) Not Applicable	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30
b. Two-way radios				
Yes	8	6	14	28
No	0	0	0	0
Not Applicable	2	0	0	2
If yes, how many?				
1) 1	0	0	1	1
2) 3	1	0	1	2
3) 4	0	0	1	1

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
4) 8	0	1	0	1
5) 10	2	0	0	2
6) 13	0	1	0	1
7) 20	0	0	1	1
8) 23	0	1	0	1
9) 25	0	0	2	2
10) 40	0	1	0	1
11) 42	0	0	1	1
12) 43	1	0	0	1
13) 45	0	0	1	1
14) 60	0	0	2	2
15) 62	0	0	1	1
16) 66	0	0	1	1
17) 75	1	0	0	1
18) 100	0	1	0	1
19) 104	1	0	0	1
20) 196	0	0	1	1
21) 281	0	0	1	1
22) 315	0	1	0	1
23) 525	1	0	0	1
24) Unspecified	1	0	0	1
25) Not Applicable	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

c. "Page-boy" call system

Yes	8	6	14	28
No	0	0	0	0
Not Applicable	2	0	0	2
If yes, how many?				
1) 0	0	1	3	4
2) 1	0	0	1	1
3) 2	0	0	1	1
4) 5	0	0	1	1
5) 6	1	1	0	2
6) 7	0	1	0	1
7) 9	0	0	2	2
8) 10	1	1	1	3
9) 15	1	0	0	1
10) 50	1	0	0	1
11) 74	0	0	1	1
12) 99	1	0	0	1
13) 130	0	0	1	1
14) 148	0	1	0	1
15) 200	0	1	0	1
16) 208	0	0	1	1
17) 700	1	0	0	2

	High	Medium	Low	Total
	Number of Responses	Number of Responses	Number of Responses	Number of Responses
18) 1 Network	0	0	1	1
19) 3 Networks	0	0	1	1
20) Unspecified	1	0	0	1
21) Not Applicable	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30
d. Radio Telephone				
Yes	8	6	14	28
No	0	0	0	0
Not Applicable	2	0	0	2
If yes, how many?				
1) 0	5	4	10	19
2) 1	1	1	3	5
3) 2	1	1	0	2
4) 8	0	0	1	1
5) Unspecified	1	0	0	1
6) Not Applicable	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30
e. Other, specify				
No additional equipment	3	1	6	10
Home Crash Alarm Telephone System	1	0	0	1
Magnetophone	1	0	0	1
Sirens	1	0	0	1
Public Address Systems	2	2	4	8
Telephones	0	1	2	3
Loudspeakers	0	0	1	1
Bullhorns	0	0	1	1
Hill P. A. Megaphones	0	0	1	1
Emergency Radio System (ERS)	1	0	0	1
DOE HF Radio System	0	2	0	2
Air/Ground Radio Systems	0	1	1	2
Amateur Radio Associations	1	0	2	3
Citizens Band Channels	0	0	1	1
Remotes & Base Stations	0	1	0	1
Announcements over A. M. Broadcasts	0	1	0	1
Microwave	0	0	1	1
Emergency Networks for Other Agencies	0	0	3	3
NAWAS	1	0	0	1
Integrating Patch System		0	1	1

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
12.2 How will field survey results be reported back to your emergency control center?				
1) Walkie-talkie	2	0	1	3
2) Radio	7	3	10	20
3) Amateur radio	1	0	0	1
4) Telephone	4	3	6	13
5) Radio-telephone	0	0	1	1
6) In person/messenger	2	2	5	9
7) ECTS	1	0	0	1
8) Not Applicable	2	0	1	3
9) No Response	0	1	0	1
12.3 With what groups have you established communication channels to obtain emergency assistance from and/or provide information to? Check all that apply.				
a. Nuclear Regulatory Commission	3	0	0	3
b. Department of Energy	8	6	13	27
c. State Radiological Control Personnel	4	0	2	5
d. Local Police Department	7	3	13	23
e. Local Fire Department	6	3	13	22
f. Local Government	6	1	8	15
g. Medical Center	8	5	13	26
h. Management Staff	8	6	13	27
i. Public Information Media	7	2	8	17
j. Others;				
1) Other contractor	2	0	3	2
2) FBI	0	0	3	3
3) Disaster Service	1	0	1	3
4) Forest Service	1	0	1	2
5) DOE	1	0	0	2
6) Atomic Industrial Forum	1	0	0	1
7) State/local Govern. Organizations	4	0	3	6
8) Misc. Federal Agencies	1	0	2	3
9) Medical AidNetwork	0	0	1	1

	High	Medium	Low	Total
	Number of Responses	Number of Responses	Number of Responses	Number of Responses
12.4 Are routine practices (drills) held to test your communication network?				
Yes	7	6	13	26
No	1	0	1	2
Not Applicable	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

How often?

1) Daily	0	1	1	2
2) Weekly	1	0	0	1
3) Bi-monthly	1	0	0	1
4) Monthly	1	3	6	10
5) Quarterly	2	0	0	2
6) Semi-annually	1	0	1	2
7) Annually	1	2	1	4
8) Checked during daily operation	0	0	3	3
9) Not Applicable	3	0	4	4
10) No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

12.5 How satisfied are you with your communication network?

1) Very dissatisfied	0	0	1	1
2) Dissatisfied	0	0	0	0
3) Slightly dissatisfied	2	1	1	4
4) Neither dissatisfied nor satisfied	0	0	1	1
5) Slightly satisfied	2	0	1	3
6) Satisfied	3	2	9	14
7) Very satisfied	1	3	1	5
8) Not Applicable	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

12.6 Is your communication network periodically reviewed?

Yes	8	6	13	27
No	0	0	1	1
Not Applicable	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
By whom?				
1) Emergency Planner	1	0	2	3
2) Radio, Electronics	3	1	0	4
3) DOE	2	2	3	7
4) Inhouse, Management/Committee	3	2	6	11
5) Inhouse	4	0	7	14
6) Security	0	1	2	3

12.7 Do you have plans for changes or improvements?

a) Describe

Yes	6	2	10	18
No	2	4	4	10
Not Applicable	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

b) When will the changes be made?

c) Please provide additional comments about your present or future communication requirements.

Hazard-Potential

<u>Classification</u>	<u>Response</u>
<u>High</u>	
1) a.	Four dedicated telephone lines, four radios operable through a repeater station, eight tone-squelch-equipped walkie-talkies operable through a repeater station, and an on-site "crash alarm system" that will ring 17 phones at once and connect them all into a conference call.
b.	By 10-30-80, for the dedicated telephone lines. The radios have not been ordered yet - all repeater stations are "full" - we may have the radios by March, 1981 depending on DOE-RL funding and approval. GTE is designing the "crash alarm system" and has not given us a projected completion date.
c.	We plan to install tape recorders on the dedicated telephone lines that will automatically record all calls. We also plan to install several video computer terminals if the proposed Emergency Radiological Detection System is implemented.

- 2) a. (1) Obtain separate emergency frequency; (2) Upgrade telephone service
 - b. (1) Within a year (2) Currently in progress
 - c. Provision of channel guard capability on radios
- 3) a. Update/upgrade radio frequency. Repeater stations (Constant upgrade, management)
 - b. 1981 and 1982
 - c. 1981 Siren upgrade program - provide better emergency siren notification - must pass budget committee. Upgrade Patrol radio system to include personal duress alarms.
- 4) a. Radio units being placed on computerized P.M. program to reduce down time
 - b. Being implemented now
 - c. Evaluate the need for additional telephone capacity. Telephone interface capability for pager is planned
- 5) a. Request for more walkie-talkies have been ordered
 - b. As soon as TSO receive their new radios
 - c. We are presently looking for a wireless radio telephone that can be used both on-site and off-site
- 6) a. Additional radio frequency, teletypes, dimension system
 - b. ASAP planning complete, instrument beginning
 - c. No comment

Medium

- 1) c. Soon will require some modification due to forthcoming relocation, on-site, of some H&N offices
- 2) a. Install new security base station, new com-center console, upgrade system to PL, new portable for emergency personnel.
 - b. As budget permits
 - c. Digital Voice Protection (DVP) for security operations
- 3) a. Gradual Upgrade replace aging equipment with newer equipment
 - b. On a continuing basis

- c. It is anticipated that future requirements will involve a Radiological Assistance Program (RAP) communications van and a radio base station to support Nuclear Emergency Search Team (NEST) functions. It is also expected that the Emergency Radio System (ERS) will be replaced as a result of improved technology

Low

- 1) a. Radio Plan approved and implementation is in progress
 - b. To be completed by FY-1984
 - c. The Master Radio Plan will provide for better radio coverage
- 2) a. Facility Master Radio Plan
 - b. 1980-1984
 - c. With implementation of the Master Radio Plan, our requirement should be met. PA system is being reviewed for future improvements
- 3) a. Upgrading radio equipment and new DOE site radio networks for safeguards and paging as per DOE-ORO Master plans FY84
 - b. The Y-12 Plant Public Address System which is used to instruct and notify plant population using evacuation alarms and emergency announcements needs upgrading. Complete renovation cost is approximately \$8 million
- 4) a. Upgrading of Security Network to repeater system. Upgrading of plant PA system
 - b. In progress at present time.
 - c. The need exists for off-site emergency communication link.
- 5) a. Tie into City Ham Radio Emergency Network
 - b. Expected by June 1981
- 6) a. Upgrade of radio net - improve equipment (radio - mobile and portables)
 - b. In process now and continuing
 - c. No response
- 7) a. We have established a five year upgrade
 - b. Reviewed in FY-81.
 - c. All communications at ID are to be reviewed and updated every five years

- 8)
 - a. Revise Hill P.A., increase radio contact to building managers, add mobile control van, improve underground cables
 - b. Some in process, some need funding
 - c. Need to improve underground cables, add amplifiers and speakers to Hill P.A. improve link to public link information media. Reliable radio telephone system is desirable.
- 9) Absolutely illegible response
 - a. Provide Emergency Communications Vehicle. Provide secured Process Telephone Service
 - b. Emergency Communications Vehicle - 1981. Process Telephone System - by 1982
 - c. Our communications systems are reasonably adequate and will be completely adequate by the end of 1982
- 10)
 - a. No Response
 - b. No Response
 - c. Walkie-talkies or 2-way radios would be desirable
- 11)
 - a. Additional communicator with medical facilities
 - b. About one year
 - c. No Response

MODULE 13

QUALITY ASSURANCE

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
13.1 Quality Assurance Organization				
a. Do you have a documented quality assurance (QA) program that covers emergency operations?				
Yes	3	3	5	11
No	6	3	7	16
Not Applicable	0	0	2	2
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
b. Does the program cover all contractors and subcontractors working on your site?				
Yes	2	2	4	8
No	1	1	1	3
Not Applicable	6	3	9	18
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
c. Do you have a documented QA program that covers environmental monitoring?				
Yes	6	4	8	18
No	3	2	4	9
Not Applicable	0	0	2	2
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
d. Does this program cover all contractors and subcontractors working on your site?				
Yes	1	3	6	10
No	4	2	3	9
Not Applicable	3	1	4	8
No Response	<u>2</u>	<u>0</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
e. Do you have an identifiable QA function (QA office, QA officer, QA staff) within your organization?				
Yes	8	5	11	24
No	1	1	1	3
Not Applicable	0	0	2	2
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
f. Does the QA staff review the site emergency plan?				
Yes	2	2	4	8
No	7	3	8	18
Not Applicable	0	0	2	2
No Response	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30
g. What is the review frequency?				
1) Quarterly or more	0	0	1	1
2) Annual	2	1	1	4
3) Biannual	0	0	1	1
4) After revisions	0	1	1	2
5) Not Applicable	7	4	10	21
6) No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
h. Does the QA staff review the environmental surveillance program?				
Yes	5	2	6	13
No	5	3	6	14
Not Applicable	0	1	2	3
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30
i. What is the review frequency?				
1) Semiannual	0	0	1	1
2) Annual	3	1	4	8
3) Biannual	1	0	1	2
4) Irregular	1	1	0	2
5) Not Applicable	5	4	8	17
6) No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
j. Does the QA staff review the emergency training given to the emergency staff and plant personnel?				
Yes	2	1	2	5
No	6	4	8	18
Not Applicable	<u>2</u>	<u>1</u>	<u>4</u>	<u>7</u>
Total Observations	10	6	14	30

13.2 Equipment Procurement and Testing

- a. Do the procurement specifications for effluent and environmental monitoring equipment address those factors which might be affected by any projected emergency situation such as:

Range?

Yes	9	5	7	21
No	0	0	3	3
Not Applicable	0	1	3	4
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

Accuracy?

Yes	9	5	7	21
No	0	0	3	3
Not Applicable	0	1	3	4
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

Environmental stresses such as temperature, humidity, etc.?

Yes	9	4	7	20
No	0	1	3	4
Not Applicable	0	1	3	4
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
b. Do you require certification by vendors or manufacturers that monitoring equipment was actually tested and met procurement specification?				
Yes	7	1	6	14
No	2	4	4	10
Not Applicable	0	1	3	4
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
c. Do your portable survey instruments meet the specifications of the American National Standards Institute, ANSI N320, "Performance Specifications for Reactor Emergency Radiation Monitoring Instruments?"				
Yes	2	1	4	7
No	2	0	3	5
Do not know	5	5	5	15
Not Applicable	0	0	2	2
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
d. Do you have the capability at your site to determine if procurement specifications on monitoring equipment have been met?				
Yes	7	5	10	22
No	2	0	1	3
Not Applicable	0	1	6	4
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
e. Do you perform acceptance testing of new monitoring instruments against the procurement specifications?				
Yes	6	5	10	21
No	1	0	1	2
Not Applicable	2	1	3	6
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
f. What percentage of new instruments receive acceptance testing?				
1) Zero	0	0	0	0
2) Less than 25%	0	0	1	1
3) 25 to 50%	1	0	0	1
4) 50 to 75%	1	0	0	1
5) 75 to 90%	1	0	1	2
6) 90 to 100%	3	5	9	17
7) Not Applicable	3	1	3	7
8) No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

13.3 Documentation

- a. Do you have a central repository for all QA records (calibrations, control charts, cross checks, etc.)?

Yes	1	3	4	8
No	8	2	8	18
Not Applicable	0	1	2	3
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

- b. Are they maintained at separate locations within your organization?

Yes	4	5	3	12
No	0	0	2	2
Not Applicable	5	1	9	15
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

- c. How long are QA records maintained?

1) 2 years	1	0	0	1
2) 3 years	0	0	1	1
3) 5 years	2	1	2	5
4) 75 years	0	0	1	1
5) 98 years	2	0	4	6
6) Not Applicable	4	5	6	15
7) No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

MODULE 14

QUALITY CONTROL

		<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
		<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
		<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
14.1 Quality Control (QC) On Effluent Monitoring					
a. Do you have written procedures for calibrating effluent monitoring programs?					
Air					
	Yes	6	5	6	17
	No	3	0	5	8
	Not Applicable	<u>1</u>	<u>1</u>	<u>3</u>	<u>5</u>
	Total Observations	10	6	14	30
Water					
	Yes	6	3	7	16
	No	3	0	4	7
	Not Applicable	<u>1</u>	<u>3</u>	<u>3</u>	<u>7</u>
	Total Observations	10	6	14	30
b. Do you have written procedures for operating effluent monitoring equipment?					
Air					
	Yes	7	5	6	18
	No	2	0	5	7
	Not Applicable	<u>1</u>	<u>1</u>	<u>3</u>	<u>5</u>
	Total Observations	10	6	14	30
Water					
	Yes	7	3	7	17
	No	2	0	4	6
	Not Applicable	<u>1</u>	<u>3</u>	<u>3</u>	<u>7</u>
	Total Observations	10	6	14	30
c. Are the air and water effluent monitoring instruments on a preventive maintenance schedule?					
	Yes	7	5	6	18
	No	2	0	5	7
	Not Applicable	<u>1</u>	<u>1</u>	<u>3</u>	<u>5</u>
	Total Observations	10	6	14	30

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

d. What is the frequency?

Air

1) Monthly	2	4	3	9
2) Quarterly	2	1	2	5
3) Annually	1	0	1	2
4) Semi-annual	1	0	0	1
5) Not Applicable	3	1	8	12
6) No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

Water

1) Monthly	1	2	2	5
2) Quarterly	1	1	3	5
3) Annually	2	0	1	3
4) Semi-annual	1	1	0	2
5) Not Applicable	3	2	8	13
6) No Response	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

e. Are your effluent monitors calibrated over the range from normal operations to DBA (Design Basis Accident)?

Yes	3	3	6	12
No	3	2	4	9
Not Applicable	2	1	4	7
No Response	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

f. In the past five years, how many failures of effluent monitoring equipment have you experienced?

a) Air

1) False Positive

0	0	2	1	3
1	1	0	0	1
2	1	0	0	1
10	0	1	0	1
Not Applicable	2	2	3	7
No Response	<u>6</u>	<u>1</u>	<u>10</u>	<u>17</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
2) Activity Present Not Detected				
0	2	2	1	5
10	0	1	0	1
Not Applicable	2	2	3	7
No Response	<u>6</u>	<u>1</u>	<u>10</u>	<u>17</u>
Total Observations	10	6	14	30

3) Equipment Out-of-Service				
0	0	0	0	0
1	1	1	0	2
2	1	0	1	2
5	0	1	0	1
6	0	0	1	1
10	0	1	0	1
20	1	0	0	1
40	0	0	1	1
98	0	0	0	0
1500	0	0	1	1
Not Applicable	2	2	3	7
No Response	<u>5</u>	<u>1</u>	<u>7</u>	<u>13</u>
Total Observations	10	6	14	30

b) Water

1) False Positive				
0	2	1	2	5
2	0	0	1	1
10	1	1	0	2
Not Applicable	2	2	3	7
No Response	<u>5</u>	<u>2</u>	<u>8</u>	<u>15</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
2) Activity Present Not Detected				
0	3	1	0	4
10	0	1	0	1
Not Applicable	2	2	2	6
No Response	<u>5</u>	<u>2</u>	<u>12</u>	<u>19</u>
Total Observations	10	6	14	30
3) Equipment Out-of-Service				
0	0	1	0	1
2	2	0	0	2
6	1	0	0	1
10	0	1	1	2
20	0	0	2	2
Not Applicable	1	2	3	6
No Response	<u>6</u>	<u>2</u>	<u>8</u>	<u>16</u>
Total Observations	10	6	14	30

g. On what frequency are the effluent-monitoring systems checked to assure that they are operational?

a. Air

Each Shift	3	0	1	4
Daily	4	5	7	16
Weekly	2	1	3	6
Not Applicable	1	0	2	3
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

b. Water

Each Shift	2	1	1	4
Daily	6	2	4	12
Weekly	0	1	3	4
None	1	0	0	1
Not Applicable	1	2	3	6
No Response	<u>0</u>	<u>0</u>	<u>3</u>	<u>3</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
14.2 QC On Monitoring Instruments and Dosimeters				
a. Do you have written calibration procedures for your emergency monitoring portable survey instruments?				
Yes	6	6	8	20
No	2	0	3	5
Not Applicable	2	0	2	4
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
b. What is the frequency of calibration?				
1) Monthly	2	2	3	7
2) Quarterly	2	3	2	7
3) Semi-annually	1	1	1	3
4) Annually	1	0	2	3
5) Per shift	0	0	1	1
6) Not Applicable	1	0	0	1
7) No Response	<u>3</u>	<u>0</u>	<u>5</u>	<u>8</u>
Total Observations	10	6	14	30
c. Do you have written operational procedures for your emergency monitoring portable survey instruments?				
Yes	4	6	6	16
No	4	0	6	10
Not Applicable	1	0	1	2
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
d. Do you maintain and calibrate your own survey instruments?				
Yes	6	4	12	22
No	3	2	0	5
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
e. Who does? (Contractor)				
1) Union Carbide	0	0	2	2
2) PNL	1	0	1	1
3) REECO	0	1	0	1
4) EG&G	1	1	0	2
5) GE	0	1	0	1
6) LBL	2	2	3	7
7) Not Applicable	6	0	7	13
8) No Response	11	3	2	16
f. Are survey instruments calibrated in accordance with ANSI N323-1978, <u>Radiation Protection Instrument</u> <u>Test and Calibration?</u>				
Yes	4	2	3	9
No	1	0	4	5
Do not know	4	4	3	11
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>3</u>	<u>3</u>
Total Observations	10	6	14	20
g. Are your survey instruments calibrated against a source which is traceable to the U.S. National Bureau of Standards?				
Yes	8	6	9	23
No	0	0	2	2
Do not know	1	0	0	1
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
h. Is the equipment in your emergency kits on a preventive maintenance schedule?				
Yes	7	5	8	20
No	1	0	2	3
Not Applicable	1	1	3	5
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
i. What is the frequency?				
1) Weekly	0	2	0	2
2) Monthly	1	1	2	4
3) 2-4 Months	2	1	5	8
4) Semiannual	2	1	1	4
5) Annual	1	1	0	2
Not Applicable	2	0	1	5
No Response	<u>2</u>	<u>0</u>	<u>2</u>	<u>5</u>
Total Observations	10	6	14	30
j. Are the dates on which maintenance was last performed and when the next scheduled preventive maintenance is due indicated on each instrument?				
Yes	7	5	9	21
No	1	1	3	5
Not Applicable	1	0	1	2
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30
k. How many points, over the range of the survey meters, are checked for calibration?				
1) None	0	0	1	1
2) One	0	3	3	6
3) Two	2	2	3	7
4) Three	0	0	3	3
5) More than three, (Specify)	3	1	2	6
6) Not Applicable	2	0	1	3
7) No Response	<u>3</u>	<u>0</u>	<u>1</u>	<u>4</u>
Total Observations	10	6	14	30

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>

l. Over how many ranges are these instruments calibrated?

1) All	1	3	0	4
2) None	0	0	1	1
3) One	1	0	0	1
4) Two	0	0	0	0
5) Three	1	1	7	9
6) Four	2	0	4	6
7) Other, (Specify)	1	0	1	2
Not Applicable	2	0	1	3
No Response	<u>2</u>	<u>2</u>	<u>0</u>	<u>4</u>
Total Observations	10	6	14	30

m. Do you have specific written procedures for use of emergency monitoring equipment?

Yes	4	5	7	16
No	4	1	5	10
Not Applicable	1	0	1	2
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

n. Do you process your own personnel dosimeters (TLD, Film Badge, etc.)?

Yes	5	4	7	16
No	3	2	6	11
Not Applicable	2	0	1	3
No Response	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total Observations	10	6	14	30

o. How long does it take to process the personnel dosimeters and receive the results back?

Routine Processing

1) <u><7</u> days	2	5	2	9
2) 14 days	2	0	6	8
3) 21 days	0	0	2	2
4) 22 days	0	0	0	0
5) 30 days	2	1	0	3
6) 48 days	1	0	0	1

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
7) 90 days	1	0	1	2
Not Applicable	1	0	2	3
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

Emergency Processing

1) <u><1</u> hour	5	2	3	10
2) 2 hour	2	0	2	4
3) 4 hour	1	1	0	2
4) 12 hour	0	2	0	2
5) 24 hour	0	0	2	2
6) 48 hour	0	0	3	3
7) 72 hour	0	1	0	1
Not Applicable	1	0	3	4
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

- p. Do you have written procedures for processing the dosimeters (including QC)?

Yes	3	3	6	12
No	1	0	0	1
Not Applicable	5	2	7	14
No Response	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30

14.3 QC On Sampling

- a. Do you have written procedures for sample collection including:

Collection?

Yes	7	3	9	19
No	2	1	2	5
Not Applicable	1	1	1	3
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
Preservation?				
Yes	5	3	8	16
No	4	1	3	8
Not Applicable	1	1	1	3
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

Packaging?				
Yes	7	3	9	19
No	2	1	3	6
Not Applicable	1	1	1	3
No Response	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

Identification?				
Yes	6	2	8	16
No	3	2	2	7
Not Applicable	1	1	1	3
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

- b. What information is included on sample tags that are attached in the field?

Time				
Yes	9	3	9	21
No	0	1	2	3
Not Applicable	1	1	1	3
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

Date				
Yes	9	4	11	24
No	0	0	0	0
Not Applicable	1	1	1	3
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

Location				
Yes	9	4	10	23
No	0	0	0	0
Not Applicable	1	1	1	3
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30

		<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
		<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
Description					
	Yes	7	3	11	21
	No	2	1	0	3
	Not Applicable	1	1	1	3
	No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
	Total Observations	10	6	14	30
On/Off Time (Air)					
	Yes	9	4	11	24
	No	0	0	0	0
	Not Applicable	1	1	1	3
	No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
	Total Observations	10	6	14	30
Volume					
	Yes	8	4	7	19
	No	1	0	4	5
	Not Applicable	1	1	1	3
	No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
	Total Observations	10	6	14	30
Individual collecting sample					
	Yes	7	3	9	19
	No	2	1	2	5
	Not Applicable	1	1	1	3
	No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
	Total Observations	10	6	14	30
c. Are unique identification numbers assigned to each sample?					
	Yes	8	4	9	21
	No	1	0	2	3
	Not Applicable	1	1	1	3
	No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
	Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
d. How often are replicate samples collected for the following media?				
Water				
1) Never	1	2	3	7
2) Yes, unspecified	5	0	3	5
3) Weekly	1	0	1	2
4) Monthly	0	1	2	4
5) Annual	0	0	0	1
6) Daily	1	0	0	1
Not Applicable	1	1	1	3
No Response	<u>1</u>	<u>2</u>	<u>4</u>	<u>7</u>
Total Observations	10	6	14	30
Air				
1) Never	2	2	4	8
2) Yes, unspecified	5	0	2	7
3) Weekly	1	0	1	2
4) Monthly	0	1	2	3
5) Annual	0	0	0	0
6) Daily	0	0	0	0
7) Bimonthly	1	0	0	1
Not Applicable	1	1	1	3
No Response	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30
Vegetation				
1) Never	3	1	4	8
2) Yes, unspecified	4	0	2	6
3) Monthly	1	0	1	2
4) Quarterly	0	0	1	1
5) Annual	0	1	1	2
Not Applicable	1	2	1	4
No Response	<u>1</u>	<u>2</u>	<u>4</u>	<u>7</u>
Total Observations	10	6	14	30
Soil				
1) Never	3	2	3	8
2) Yes, unspecified	4	0	3	7
3) Monthly	1	0	1	2

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
Soil				
4) Quarterly	0	0	1	1
5) Annual	0	1	1	2
Not Applicable	1	1	1	3
No Response	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

14.4 Analytical Quality Control

- a. Are analyses performed onsite or are they sent to an off-site analytical contractor?

Onsite	5	3	6	14
Offsite	1	0	2	3
Both	3	1	1	5
Not Applicable	<u>1</u>	<u>2</u>	<u>5</u>	<u>8</u>
Total Observations	10	6	14	30

- b. Do you have a quality control program to check the performance of the off-site contractor?

Yes	1	1	2	4
No	3	0	1	4
Not Applicable	<u>6</u>	<u>5</u>	<u>11</u>	<u>22</u>
Total Observations	10	6	14	30

- c. Are there written procedures for analysis of the following types of samples?

Effluent Samples				
Yes	8	4	9	21
No	0	0	0	0
Not Applicable	1	2	5	8
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
Environmental Samples				
Yes	8	4	8	20
No	1	0	0	1
Not Applicable	1	2	5	8
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30
Bioassay Samples				
Yes	5	4	7	16
No	3	0	0	3
Not Applicable	1	2	5	8
No Response	<u>1</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
d. Are there written analytical procedures for all nuclides which could be released in an accident situation?				
Yes	8	3	7	18
No	1	1	3	5
Not Applicable	<u>1</u>	<u>2</u>	<u>4</u>	<u>7</u>
Total Observations	10	6	14	30
e. Do you have written procedures and schedules for calibration checks on the counting instruments?				
Yes	8	3	9	20
No	1	1	1	3
Not Applicable	<u>1</u>	<u>2</u>	<u>4</u>	<u>7</u>
Total Observations	10	6	14	30
f. What is the frequency?				
1) as used	0	1	0	1
2) Daily	4	2	6	12
3) Weekly	2	0	1	3
4) Monthly	1	0	2	3
5) Annual	0	0	0	0
Not Applicable	2	3	5	10
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
g. Do you have written procedures and schedules for background determination on the counting instruments?				
Yes	9	3	9	21
No	0	1	2	3
Not Applicable	<u>1</u>	<u>2</u>	<u>3</u>	<u>6</u>
Total Observations	10	6	14	30
h. What is the frequency?				
1) Each shift	0	1	0	1
2) As used	0	1	1	2
3) Daily	6	1	7	14
4) Weekly	3	0	1	4
5) Annual	0	0	0	0
6) Not Applicable	<u>1</u>	<u>3</u>	<u>5</u>	<u>9</u>
Total Observations	10	6	14	30
i. Are the results maintained on control charts?				
Yes	6	3	5	14
No	2	1	5	8
Not Applicable	1	2	4	7
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
j. Are the laboratory instruments and radiochemical analysis procedures calibrated against standards which are either directly or indirectly traceable to the U.S. National Bureau of Standards?				
Yes	8	4	8	20
No	0	0	3	3
Do not know	1	0	1	2
Not Applicable	<u>1</u>	<u>2</u>	<u>2</u>	<u>5</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
k. Do you have written procedures which specify the actions to be taken when calibrations, background determinations, and other quality control checks are outside specifications?				
Yes	6	3	6	15
No	3	1	4	8
Not Applicable	<u>1</u>	<u>2</u>	<u>4</u>	<u>7</u>
Total Observations	10	6	14	30
l. How frequently do you analyze spiked and blank samples?				
1) Every run	1	1	0	2
2) Occasionally	1	0	2	3
3) 10% of samples	2	1	0	3
4) Never	1	0	1	2
5) Daily	2	1	3	6
6) Weekly	1	0	2	3
7) Monthly	0	0	2	2
8) Annual	0	1	0	1
9) Semimonthly	0	0	1	1
Not Applicable	1	2	3	6
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
m. What percentage of samples do you analyze in duplicate?				
1) 0%	0	0	1	1
2) 1%	0	1	1	2
3) 5%	3	2	1	6
4) 10%	3	0	2	5
5) 17%	1	0	1	2
6) 40%	0	1	0	1
7) 50%	1	0	1	2
8) 98%	0	0	1	1
Not Applicable	1	2	5	8
No Response	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
n. Are these "blind" duplicates?				
Yes	4	4	4	12
No	5	0	4	9
Not Applicable	1	2	5	8
No Response	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total Observations	10	6	14	30

o. In which intercomparison studies or performance evaluations do you routinely participate?

1) EML	6	3	9	18
2) EPA	7	3	4	14
3) NRC	0	1	0	1
4) Others	3	1	3	7
Not Applicable	1	2	4	7

p. Which nuclides are included in these studies?

High

- 1) ^{131}I , ^{60}Co , ^{51}Cr , ^{106}Ru , ^{134}Cs , ^{137}Cs , ^{65}Zn
- 2) Examples used by Q.A. Analytical Laboratories include: ^{137}Cs , $^{89-90}\text{Sr}$, ^{239}Pu
- 3) Many (Pu, U, Cs, etc.)
- 4) U, ^7Be , ^{45}Ca , ^{54}Mn , ^3H , ^{239}Pu , ^{60}Co , ^{90}Sr , ^{95}Zr , ^{125}Sb , ^{137}Cs , ^{144}Ce , ^{241}Am , ^{40}K , ^{226}Ra
- 5) ^3H , ^{238}Pu , ^{239}Pu , ^{238}U , ^{234}U , Th isotopes, ^{226}Ra
- 6) ^3H , ^{239}Pu , ^{238}U
- 7) Plutonium, Americium, Uranium, Thorium nuclide. ^{131}I , ^{134}Cs , ^{137}Cs , Rb, ^{65}Zn , ^{60}Co , ^{90}Sr
- 8) ^{137}Cs , ^{60}Co , ^{88}Ir , ^{51}Cr , ^{109}Cd
- 9) ^{137}Cs , ^{90}Sr , ^{134}Cs , ^{144}Ce , ^3H

Medium

- 1) Tritium, uranium, plutonium, uranium γ emitters
- 2) ^{241}Am , ^{57}Co , ^{203}Hg , ^{109}Cd , ^{139}Cs , ^{85}Sr , ^{137}Cs , ^{60}Co , ^{88}Ir
- 3) Tritium, plutonium

Low

- 1) All major transuranics, fission products activation products
- 2) ^{239}Pu , ^{241}Am , ^{234}U , ^{235}U , ^{238}U , ^{57}Co , ^{60}Co , ^{89}Sr , ^{90}Sr , ^{95}Zr , ^{125}Sb , ^{137}Cs , ^{144}Ce , ^{226}Ra , ^{228}Th , ^{238}Pu
- 3) Uranium, Plutonium
- 4) ^3H , ^{51}Cr , ^{60}Co , ^{65}Zn , ^{106}Ru , ^{134}Cs , ^{137}Cs , ^{58}Co
- 5) ^{239}Pu , ^{60}Co , ^{137}Cs , U, ^{237}Np
- 6) All γ emitters. ^{90}Ir , ^{234}Pu and tritium
- 7) ^3H to date. More planned eg. ^7Be
- 8) Uranium
- 9) Uranium isotopes, plutonium

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
q. Is the scope of available intercom- parison studies adequate for your program?				
Yes	8	4	5	17
No	1	0	5	6
Not Applicable	<u>1</u>	<u>2</u>	<u>4</u>	<u>7</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>
r. What additional nuclides or sample materials should be included?				
1) ^{99}Tc in soil and vegetation	0	0	1	1
2) ^{99}Tc in soil, vegetation, and animal flesh	0	0	1	1
3) ^{99}Tc	0	0	1	1
4) ^{129}I , ^{99}Tc	0	0	1	1
5) None	6	2	2	10
Not Applicable	3	4	8	15
No Response	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total Observations	10	6	14	30
s. Do you routinely split samples with other laboratories?				
Yes	1	2	4	7
No	8	3	6	17
Not Applicable	<u>1</u>	<u>1</u>	<u>4</u>	<u>6</u>
Total Observations	10	6	14	30
t. On what frequency?				
1) 3/yr.	0	0	1	1
2) Monthly	0	0	0	0
3) Quarterly	0	1	3	4
4) Annually	0	0	1	1
Not Applicable	9	4	9	22
No Response	<u>1</u>	<u>1</u>	<u>0</u>	<u>2</u>
Total Observations	10	6	14	30

14.5 Computational Checks

a. Do you have established procedures for checking all results from your analytical laboratory (or contractor)?				
Yes	5	3	7	15
No	5	1	4	10
Not Applicable	0	1	1	2
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>	<u>Number of</u>
	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>	<u>Responses</u>
b. Do you have procedures developed to calculate doses in an emergency situation?				
Yes	6	3	4	13
No	0	0	3	3
Not Applicable	1	0	1	2
No Response	<u>3</u>	<u>3</u>	<u>6</u>	<u>12</u>
Total Observations	10	6	14	30
c. Have they been independently verified as being adequate?				
Yes	1	3	3	7
No	2	0	1	3
Not Applicable	1	0	4	5
No Response	<u>6</u>	<u>3</u>	<u>6</u>	<u>15</u>
Total Observations	10	6	14	30
d. Are all dose, effluent concentration and environmental concentration calculations documented in logbooks or other permanent records?				
Yes	8	5	10	23
No	1	0	1	2
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30
e. Is there a procedure to independently check (verify) all calculations?				
Yes	1	3	6	10
No	8	2	5	15
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
f. Is a computer used for such calculations?				
Yes	5	2	7	14
No	3	3	4	10
Not Applicable	1	0	2	3
No Response	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30
g. Are all inputs and outputs verified?				
Yes	2	1	5	8
No	3	1	2	6
Not Applicable	4	3	6	13
No Response	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30
h. Are all the computer programs being used fully documented?				
Yes	3	2	4	9
No	2	0	2	4
Not Applicable	4	3	7	14
No Response	<u>1</u>	<u>1</u>	<u>1</u>	<u>3</u>
Total Observations	10	6	14	30

14.6 Procedural Audits

a. Have you developed written audit procedures?				
Yes	7	4	4	15
No	11	1	6	9
Not Applicable	1	0	1	2
No Response	<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
Total Observations	10	6	14	30
b. Do you conduct a program to independently audit compliance with operational procedures?				
Yes	8	4	5	17
No	0	1	4	5
Not Applicable	1	0	1	2
No Response	<u>1</u>	<u>1</u>	<u>4</u>	<u>6</u>
Total Observations	10	6	14	30

	<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>	<u>Number of</u> <u>Responses</u>
c. Management audit of emergency pre- paredness is performed by:				
1) DOE	7	5	7	19
2) Contractor General Manager	1	1	2	4
3) Plant Manager	2	1	2	5
4) Department Manager	2	1	3	6
5) Emergency Planner	4	0	4	8
6) Other, Specify	4	0	4	8
7) QA Dept.	1	0	0	0
8) Audit Unit	2	0	0	0
9) EP Committee	0	0	2	0
10) OP Manager	0	0	0	2
11) Not Applicable	1	0	0	1
12) Non Response	1	0	2	3
d. Who is responsible for assuring that audit findings, recommendations and corrective actions are implemented?				
1) Director Safety	1	0	2	3
2) QA	0	1	1	2
3) Management	2	4	5	12
4) Health Division	1	0	0	1
5) DOS	0	1	0	1
6) Emergency Planner	3	0	1	4
7) Contractor	1	0	0	1
Not Applicable	1	0	1	1
No Response	<u>1</u>	<u>0</u>	<u>4</u>	<u>5</u>
Total Observations	10	6	14	30

<u>High</u>	<u>Medium</u>	<u>Low</u>	<u>Total</u>
<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>	<u>Number of Responses</u>

14.7 Documentation

- a. Do you have a central repository for all QC records (calibrations, control charts, cross checks, etc.)?

Yes	2	2	5	9
No	5	3	6	14
Not Applicable	1	0	1	2
No Response	<u>2</u>	<u>1</u>	<u>2</u>	<u>5</u>
Total Observations	10	6	14	30

- b. Are they maintained at separate locations within your organization?

Yes	4	4	4	12
No	2	0	3	5
Not Applicable	3	1	5	9
No Response	<u>1</u>	<u>1</u>	<u>2</u>	<u>4</u>
Total Observations	10	6	14	30

- c. How long are QC records maintained?

1) 2 years	0	0	1	1
2) 5 years	1	1	2	4
3) 75 years	0	1	1	2
4) 98 years	4	1	5	10
5) Not Applicable	2	0	1	3
6) No Response	<u>3</u>	<u>3</u>	<u>4</u>	<u>10</u>
Total Observations	10	6	14	30

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