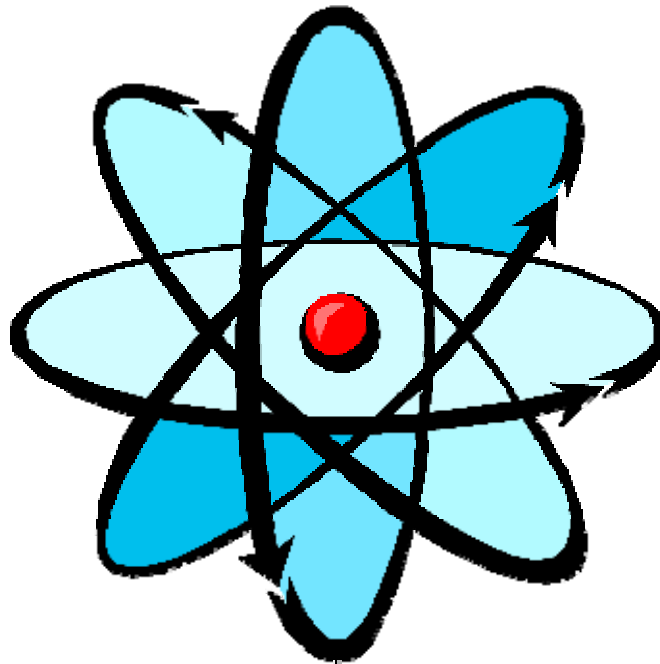


RADIATION SAFETY OFFICER  
REFRESHER

COURSE CURRICULUM



By

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## **CURRICULUM FOUNDATIONS**

### **DEFINITION OF RADIATION SAFETY OFFICER REFRESHER COURSE**

The Nuclear Regulatory Commission issued the United States Navy a Master Materials License (MML), which allows the Navy to issue Naval Radioactive Materials Permits (NRMPs) to Naval commands. The NRMP allows Naval commands to receive, possess, use, and transfer radioactive materials. The MML requires each Naval command that possess an NRMP to have a Radiation Safety Officer (RSO). The RSO is responsible for ensuring the command's compliance with all applicable Naval and Federal regulations. As the technical support center for all commands possessing NRMPs, NAVSEADET RASO is responsible for training RSOs.

The Radiation Safety Officer (RSO) refresher course is used to provide Naval RSOs with the opportunity to refresh and improve their radiation protection skills. The introduction will provide the RSOs a brief refresher on terminology and mathematics used. The remaining time will provide the RSO with new equipment, concerns and changes in radiation safety philosophies, as well as display programs that may be used as models.

The aim of the curriculum is to enhance basic RSO knowledge while expanding and updating the RSOs understanding as a whole. The RSO will participate in classes that are facilitated by NAVSEADET RASO instructors and inspectors. Students will be placed in situations where they will be encouraged to share past experiences with their fellow RSOs.

### **RATIONALE FOR RSO REFRESHER COURSE**

The RSO refresher curriculum was developed in response to feedback from the 300-400 Navy and Marine Corps RSOs who are currently performing those duties. The RSO community expressed an interest in a refresher system to allow them to sharpen old skills while learning new ones.

In response to that request, NAVSEADET RASO gathered data from the inspections performed at commands around the

world. The most common discrepancies have been identified and are targeted in this curriculum.

Due to the varied needs of command RSOs, the curriculum was divided into several categories and presented in five days. While RSOs are encouraged to attend all five days, it is possible that a command's needs would necessitate the RSO to attend from two to five days.

Enrollees in this class will vary in age and experience and will include both military and civilian RSOs. With this in mind, the course was developed with the median knowledge level in mind; however, the curriculum allows the facilitator to adjust the level of the classes as needed.

#### CONTENT SOURCE FOR RSO REFRESHER COURSE

The curriculum is derived from the Federal Regulations found in Titles 10, 29 and 49 of the Code of Federal Regulations (CFR), Naval requirements, and ANSI N43.3. Additionally, the topics were sought from the fleet RSOs, RASOs Radiation Protection Managers (RPMs) and Environmental Protection Managers (EPMs).

#### CONTENT STRUCTURE FOR RSO REFRESHER COURSE

## RSO REFRESHER COURSE AIM AND GOALS

It is the aim of this course to provide Radiation Safety Officers (RSOs) with practical information that they did not receive during their initial training, allowing them to become more effective RSOs. The course will concentrate on the improvement of the RSOs ability to manage their command Radiation Safety Program. Additionally, the program will provide the RSOs with sufficient information to adapt their command s program to future changes.

The curriculum will provide instruction and practice as follows:

1. Provide students with the tools and knowledge necessary to ensure that the command s program meets all of the applicable regulations.
2. Allow the students to practice several tasks that they are expected to perform as Radiation Safety Officers.  
For example:
  - a. Conduct internal inspections of their Radiation Safety Programs.
  - b. Conduct or supervise the performance of radiation surveys.
  - c. Perform and document annual reviews to ensure radiation exposures are kept "As Low As Reasonably Achievable" (ALARA).
3. Allow the students to meet fellow RSOs and discuss issues on which they have had concerns.
4. Introduce the learner to the latest technologies available to ensure a comprehensive Radiation Safety Program.

## CURRICULUM CONTENT

### SCOPE AND SEQUENCE

#### **Day 1    Radioactive Materials**

- Naval Master Materials License
- Sources:
  - Portable gauges (XRFs, density meters, alloy ID gauges).
  - Commodities (electron tubes, tritium watches, smoke detectors, tritium gun sights, etc).
  - Sealed sources (gamma radiography, calibrators, etc.).
  - Unsealed sources (research sources, calibration check sources, etc.).
- Radioactive Commodities:
  - Inventory (requirements, methods, records).
  - Control (security, posting).
  - Disposal (LLRW, return to manufacturer for disposition).
- Generally Licensed or Permitted Radioactive Material:
  - Tritium drogue lights.
  - Depleted uranium bullets and counter weights.
- Specifically Licensed or Permitted Radioactive Material.
  
- Shielding Issues.
- Radiation Surveys.
- Machine Control.
  
- Common Discrepancies During Audits of Radioactive Materials Programs.

## **Day 2 Machine Sources of Radiation**

- Machine types:
  - Analytical x-ray machines.
  - Industrial x-ray machines.
  - Linear Accelerators.
- Integration of new devices (production, detection, etc.).
- Shielding Issues.
- Radiation Surveys:
  - Performance:
    - Radiation protection inspection.
    - Radiation protection survey.
  - Documentation.
- Machine Control.
- Common Discrepancies During Audits of Programs Machine of Radiation.

## **Day 3 Transportation and Disposal of Radioactive Material**

- Commodities and Low Activity Sources:
  - Limited Quantities.
  - Instruments and Articles.
- Type A Quantities:
  - Special consideration.
- Type B Quantities:
  - Special Considerations.
- Special Shipments:
  - Contacting and coordinating with RASO.

#### **Day 4 Environmental and Emergency Issues**

- Emergency or priority assistance:
  - RSO Listing.
  - Available resources from RASO.
  - Electronic medium (digital cameras, faxes, email, etc).
- USRADs survey capabilities.
- Low Level Radioactive Waste (LLRW) program update.
- Environmental Requirements:
  - Decommissioning records.
  - RSO duties.
- Political rules of thumb during incidents:
  - Low stress situation.
  - High stress situation.
- Review NAVMED Instruction 6470.10A
  - Guidance on medical actions for severe exposures to radiation.

#### **Day 5 - Trends & Issues**

- Presentations and Discussions by Attendees (Moderated by RASO Staff).
  - Common findings during RASP inspections:
    - Potential problem areas (areas of concern) noted by inspectors.
    - Potential problem areas (areas of concern) noted by Radiation Safety Officer.
  - Programs that have been graded as above average.
    - Naval shipyard.
    - Military command.
  - Expected changes in the program.
    - Changes to the RAD-010.
    - Changes to the code of federal regulations:
      - 10 CFR (Nuclear Regulatory Commission)
      - 49 CFR (Department of Transportation)

- Annual review of program implementation (formerly ALARA review).
- Common discrepancies noted in radiation health programs:
  - Radiation Health Assistant (RHA) program errors with Windows NT.
  - Improper radiation health physical at prior command.

UNIT #1: Special Considerations for Source Materials of Ionizing Radiation.

TIME: 8 hours.

UNIT GOALS:

1. Provide awareness of recent changes to the Naval Master Materials License (NMML).
2. Reinforce the students understanding of the controls required for radioactive materials, including radioactive commodities.
3. Provide access and the ability to use the Navy radioactive materials database.
4. Clarify the requirements for RSOs to maintain control of generally licensed materials.

RATIONALE FOR UNIT:

Recent events involving the loss of control of radioactive materials have highlighted a need to improve the general Radiation Safety Officer's level of knowledge concerning controls of radioactive materials, specifically radioactive commodities, and the administration of their command's radiation safety program.

Additionally, through data collection and analysis, NAVSEADET RASO has identified trends in the discrepancies noted during RASO inspections. Although these discrepancies are found in the majority of the programs, several programs have consistently received zero discrepancies. Identifying common discrepancies and the methods used by the more successful commands will allow the RSOs to prevent these discrepancies from occurring in the future.



OBJECTIVES FOR UNIT:

1. Identify radioactive materials in the Naval supply system.
2. Explain the need for control of radioactive material.
3. Identify reporting requirements for loss of radioactive material.
4. Evaluate a radioactive materials program to ensure the necessary requirements are met.

POSSIBLE UNIT ACTIVITIES:

1. Provide students with various radioactive/non-radioactive items and require them to determine the radiological controls needed for that item.
2. Provide a storage area containing radioactive materials and require the student to perform an audit of the area, citing discrepancies and possible corrective actions.

REFERENCES:

1. NAVSEA S0420-AA-RAD-010 (RAD-010).
2. Naval Master Materials License.
3. NAVSEADETRASOINST 5104.1.
4. NAVSUPPUB 505.

UNIT #2: Special Considerations For Machine Sources of Ionizing Radiation.

TIME: 8 hours.

UNIT GOALS:

1. Introduce new radiation producing devices available for purchase.
2. Introduce new radiation detection devices available for purchase.
3. Clarify radiation protection survey requirements.
4. Introduce new requirements for the control and registration of radiation producing machines.
5. Provide awareness of the most common discrepancies noted during RASO inspections and discuss methods for avoiding those discrepancies.

RATIONALE FOR UNIT:

In the past few years several new radiation producing devices and detection devices have been introduced to the field. These new devices provide more reliable safety features and accuracy in measuring the presence of radiation. Keeping the RSO current on the latest technologies will provide them the opportunity to improve their radiation protection capabilities.

Additionally, through data collection and analysis, NAVSEADET RASO has identified trends in the discrepancies noted during RASO inspections. Although these discrepancies are found in the majority of the programs, several programs have consistently received zero discrepancies. Identifying common discrepancies and the methods used by the more successful commands will allow the RSOs to prevent these discrepancies from occurring in the future.

#### OBJECTIVES FOR UNIT:

1. Evaluate new radiation producing equipment and describe the additional safety benefits you would receive from these devices.
2. Evaluate new radiation detection equipment and produce a written point paper, highlighting possible uses and benefits, as well problems and possible misuses, as they pertain to safety of these devices.
3. Perform a simulated audit of an x-ray radiation safety program, detailing the discrepancies noted, and identify the possible corrective actions of the RSO.

#### POSSIBLE UNIT ACTIVITIES:

1. Perform a mock audit of an entire x-ray radiography program.
2. Conduct a mock vault survey.
3. Perform an audit of a temporary open facility x-ray operation.
4. Review sample documents for completeness during a simulated RSO review.

#### REFERENCES:

1. NAVSEA S0420-AA-RAD-010 (RAD-010)
2. LORAD X-ray Machine Operations Manual
3. NAVSEADETRASOINST 5104.1

UNIT #3: Special Considerations for Transportation of Radioactive Materials on Public Highways.

TIME: 8 hours.

UNIT GOALS:

1. Provide supplemental information to the RSOs that will allow them to more easily determine the proper shipping requirements.
2. Identify recent changes in the transportation regulations for radioactive material.
3. Identify the most commonly noted discrepancies during transportation of radioactive material.

RATIONALE FOR UNIT:

Recent enforcement actions by the Department of Transportation (DOT) and the Nuclear Regulatory Commission (NRC) indicate a need for additional training on the requirements of transporting radioactive material.

The requirements for transporting radioactive materials are continuously being revised. Several RSOs have indicated a desire for additional training on the revised requirements.

Additionally, through data collection and analysis, NAVSEADET RASO has identified trends in the discrepancies noted during RASO inspections. Although these discrepancies are found in the majority of the programs, several programs have consistently received zero discrepancies. Identifying common discrepancies and the methods used by the more successful commands will allow the RSOs to prevent these discrepancies from occurring in the future.

OBJECTIVES FOR UNIT:

1. Identify the different classes of shipping categories.
2. Determine the information and format required for proper shipping papers.
3. Properly package radioactive materials for shipping.
4. Identify discrepancies on shipping papers and provide corrected information.
5. Identify and correct discrepancies on improperly packaged radioactive material.

POSSIBLE UNIT ACTIVITIES:

1. Provide students with materials that need to be transported across public highways. Require the students to properly package and prepare shipping paperwork for transportation.
2. Present student with radioactive materials in a package with associated shipping papers and require the student to identify discrepancies and determine possible corrective actions.

REFERENCES:

1. NAVSEA S0420-AA-RAD-010 (RAD-010)
2. Title 49 Code of Federal Regulations (DOT)
3. Title 10 Code of Federal Regulations (NRC)

UNIT #4: Environmental and Emergency Issues.

TIME: 8 hours.

UNIT GOALS:

1. Inform the students of environmental services available from NAVSEADET RASO and other government agencies.
2. Provide students with an understanding of the decommissioning process, including clean up and disposal.
3. Raise the students awareness of the potential emergency conditions and provide insight into the possible emergency actions.

RATIONALE FOR UNIT:

First, due to the reduction in force and the associated Base Realignment And Closures (BRAC), many RSOs are tasked with providing the necessary support for the decommissioning of commands. In the past, the RSOs have not been trained in this function.

Second, the Department of Defense (DoD) has consolidated all low-level radioactive waste (LLRW) disposal through one central office. NAVSEADET RASO is responsible for coordinating all Naval LLRW disposals. RSOs need to be informed of the processes and procedures that they will be required to follow during disposal operations.

Third, recent emergency conditions have indicated that all RSOs are not thoroughly familiar with their responsibilities during emergency conditions.

Finally, through data collection and analysis, NAVSEADET RASO has identified trends in the discrepancies noted during RASO inspections. Although these discrepancies are found in the majority of the programs, several programs have consistently received zero discrepancies. Identifying common discrepancies and the methods used by the more successful commands will allow the RSOs to prevent these discrepancies from occurring in the future.

#### OBJECTIVES FOR UNIT:

1. Demonstrate an understanding of decommissioning requirements and the RSOs responsibilities within that program.
2. Demonstrate an understanding of the LLRW program and the RSOs responsibilities within that program.
3. Define the required RSO actions during various emergency conditions.

#### POSSIBLE UNIT ACTIVITIES:

1. Provide students with case studies of decommissioning Naval sites for correctness and alternative procedures.
2. Provide students with LLRW materials that require disposal and have the student perform all actions the RSO would be required to perform for disposal of that LLRW.
3. Perform a radiation emergency drill placing emphasis on the actions of the RSO.
4. Review draft OPREP and SITREP messages.
5. Design a pre-plan for potential emergency conditions.

#### REFERENCES:

1. NAVSEA S0420-AA-RAD-010 (RAD-010)
2. Department of Defense 4715. 6-R
3. NAVSEADETRASOINST 5104.1
4. NAVMEDINST 6470.10A
5. OPNAVINST 3100.6

UNIT #5: Trends and Issues in the Naval Radioactive Affairs Support Program (RASP).

TIME: 8 hours.

UNIT GOALS:

1. Familiarize RSOs with common errors in command RASPs as seen by NAVSEADET RASO.
2. Address the concerns and issues noted by the attending RSOs.
3. Provide examples of well-run RASPs, including computer files.
4. Address recent and future changes, determining their impact and possible solutions.

RATIONALE FOR UNIT:

RSOs from the fleet have provided feedback to NAVSEADET RASO that indicated the need for open, but mediated, dialog between Naval RSOs and NAVSEADET RASO personnel. This unit will provide that forum with a facilitator directing the dialog.

Past incidents in the Navy and Marine Corps have revealed a lack of public relations intelligence in the RSO community. Addressing these issues in this unit will reduce the likelihood of a recurrence of these public affairs blunders.

Additionally, through data collection and analysis, NAVSEADET RASO has identified trends in the discrepancies noted during RASO inspections. Although these discrepancies are found in the majority of the programs, several programs have consistently received zero discrepancies. By identifying the common discrepancies and the methods used by the more successful commands, it will allow the RSO to prevent these discrepancies from occurring in the future.

OBJECTIVES FOR UNIT:

1. Identify common areas of concern in command programs and address possible solutions.
2. Discuss possible incidents in which RSOs may be involved, and determine proper courses of actions for various scenarios.

3. Identify recent and possible future changes in the RASP.
4. Evaluate the successful RASP and collect solutions for improving their RASP.

#### POSSIBLE UNIT ACTIVITIES:

1. Role-play a sensitive incident allowing the individuals to perform the functions of the key players.
2. In small groups, allow the RSOs to brainstorm for a complete guide to performing audits.
3. Stage a simulated RASP inspection of a poor program and follow it with an inspection of an above average program.

#### REFERENCES:

1. NAVSEA S0420-AA-RAD-010 (RAD-010).
2. Title 10 Code of Federal Regulations.
3. NAVSEADETRASOINST 5104.1

## **CURRICULUM EVALUATION**

### **Student Evaluation Samples**

Sample student evaluation sheets are included to determine the effectiveness of the training program. Sample questions are provided for each unit of this curriculum. If an individual did not attend all units they would not be required to complete all questions.

Additionally, a sample checklist for use with Unit 3's practical examination is provided at the end of the sample questions and situations.

**Unit 1:** Special Considerations for Source Materials of Ionizing Radiation.

1. Using the materials provided, determine the need for radiological controls.
2. Cite the references that require control of electron tubes and discuss why these controls are needed for such low levels of radioactivity.

**Unit 2:** Special Considerations for Machine Sources of Ionizing Radiation.

1. List and describe one new radiation detection device. Provide an analysis of this device and describe at least two advantages and two disadvantages of using this device at your program.
2. Using the following video and associated records, determine the adequacy of the radiological controls for the temporary x-ray radiation area. List discrepancies noted and recommend corrective actions.

**Unit 3:** Special Considerations for Transportation of radioactive Materials on Public Highways.

1. Using the items provided, determine the appropriate shipping classification and prepare the package for shipping, including shipping papers. The package will be shipped from NAVSEADET RASO to your command.
2. Using the items provided, evaluate the packages provided. Determine their acceptability for shipping as labeled. List all discrepancies and corrective actions.

**Unit 4:** Environmental and Emergency Issues.

1. Evaluate the provided incident and describe the appropriate response for the RSO. List any communications (person-to-person or electronically) that you would perform.

SITUATION:

You are the RSO at NAVSTA Norfolk and you receive the following call:

*(In a frantic voice)*

"VA State Trooper Jones here, are you the RSO? I got your number from the base CDO.

We have a situation at I-64 and Mercury Blvd. I need your assistance with this.

A green Navy truck dropped a device off of the I-64 bridge onto Mercury Blvd. The device is shattered all



over the road. We approached the device and saw radiation warnings and the word Troxler.

Your CDO said you would help me! We have Mercury Boulevard and I-64 closed down! I need some help here right NOW!!!"

2. During a recent BRAC session your command was identified for closure. Describe the steps you need to take to ensure the smooth transition of your property to the local government.

**Unit 5:** Trends and Issues in the Naval Radioactive Affairs Support Program (RASP).

1. List four changes you plan to make in your program, and provide your rationale for making those changes.
2. Describe the future of the RASP program as you see it, and describe the challenges that you expect to face in the next year.

**Sample Evaluation Form  
Unit 3**

**Student Problem:** Using the items provided, determine the appropriate shipping classification and prepare the package for shipping, including shipping papers. The package will be shipped from NAVSEADET RASO to your command.

Complete the evaluation by placing an X in the appropriate block. The point value for each critical item is indicated in the "PTS" column. Students begin with 100 points; subtract the appropriate point value for all "NO" responses, a minimum score of 80% must be achieved to be considered satisfactory.

1. Material Identification	YES	NO	PTS
A. Does the student verify Source type and activity?			5
• Does the student verify material containment?			5
• Does the student obtain serial number if applicable?			5

• Does the student determine the correct A1 or A2 value?			5
2. Packaging selection:	YES	NO	PTS
A. Does the student select the appropriate class of packaging (Type A or Type B)?			5
• Does the student select packaging that was specifically designed for the item being shipped?			5
• Does the student verify the packaging certification is current?			5
3. Packaging the material:	YES	NO	PTS
A. Did the student properly seal the package?			5
• Did the student apply the appropriate labels on the package?			5
• Did the student apply the appropriate markings to the package?			5
4. Shipping Papers:	YES	NO	PTS
A. Do the completed shipping papers contain the following:			
a. Complete material description?			5
b. Name of the radionuclide?			5
c. Physical & chemical form?			5
d. Source activity in SI units?			5
e. Category of labels applied?			5
f. Transport index?			5





### **VALIDATION OF RADIATION SAFETY OFFICER'S REFRESHER**

A copy of the curriculum will be forwarded to three experts in the field of radiation protection and program management. All experts are employees of the United States Navy and are responsible for the day-to-day supervision of the Navy's radiation protection program. A brief description of these individuals is listed below.

Commander Steven Doremus is the Officer in Charge of Naval Sea Systems Command Detachment, Radiological Affairs Support Office (NAVSEADET RASO). CDR Doremus has 24 years of experience in the field of radiation health, and he has received a doctorate in radiation science.

Richard Lowman has 27 years of work with radiological controls. For the last 17 years Mr. Lowman has held the position of director of operations at NAVSEADET RASO. In addition, Mr. Lowman holds a masters degree in education.

William Morris holds a masters of science in nuclear engineering, as well as professional certification by the American Board of Health Physics as a health physicist. Mr. Morris has 31 years of experience in radiation protection, 25 of those years have been with NAVSEADET RASO, both as a field inspector and an administrator.

NAVSEADET RASO is responsible for providing regulatory oversight, technical advice and training to all commands that possess, use or transfer industrial radioactive materials or machines.

August 28, 2001

Commander Steven Doremus

NAVSEADDET RASO

P.O. Drawer 260

NWS Yorktown, VA 23691-0260

Commander Doremus,

The enclosed curriculum was designed in response to requests from Naval Radiation Safety Officers, as well as to ensure the Radiation Safety Officers are properly informed, allowing them to adjust to the rapidly changing field of radiation protection.

The curriculum is intended to provide the students with a refresher of the basic knowledge required to qualify as a Radiation Safety Officer, as well as to expand the knowledge level to include real world problems and solution experienced by current Radiation Safety Officers.

In addition to completing the enclosed validity survey, I welcome any additional comments or suggestions you may have concerning the content of the information, as well as the order in which it is presented.

I appreciate your taking time from your busy schedule to evaluate this curriculum. Please return the completed evaluation by September 1, 2000, so that modifications, if necessary, can be completed by the following fiscal year, which starts October 1, 2000.

Please feel free to contact me with any questions at (757) 887-4692. Thank you in advance for your help.

Sincerely,

Kenneth L. Gornto

HTCS(SW) USN

August 28, 2001

Richard Lowman

NAVSEADDET RASO

P.O. Drawer 260

NWS Yorktown, VA 23691-0260

Mr. Lowman,

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Kenneth L. Gornto

HTCS(SW) USN

August 28, 2001

William Morris

NAVSEADDET RASO

P.O. Drawer 260

NWS Yorktown, VA 23691-0260

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Sincerely,

Kenneth L. Gornto

HTCS(SW) USN

RADIATION SAFETY OFFICER'S REFRESHER COURSE

CONTENT VALIDITY

Complete the following survey by placing an X in the appropriate block.		
1. Does the content provide the information that an RSO is expected to understand:	Yes	No
A. surveys and audits?		
• emergency actions?		
• requirements for transportation of radioactive material?		
• identification of radioactive commodities?		
• disposal of low-level radioactive waste?		
2. Does the content:	Yes	No
A. flow from unit to unit?		
• contain all information necessary?		
3. Are the learning activities:	Yes	No
A. adequate to provide the experiences an RSO needs?		
• difficult enough to require the to draw on multiple resources?		
• realistic in their application?		
4. Units	Yes	No
A. Are the goals and objective adequate for each unit?		
• Arrange in a manner that facilitates learning?		
5. Additional comments		



