Wildland Fire Chain Saws
S-212

NATIONAL WILDFIRE COORDINATING GROUP™

NFES 002660

Instructor Guide

DECEMBER 2012

CERTIFICATION STATEMENT

on behalf of the

NATIONAL WILDFIRE COORDINATING GROUP

The following training material attains the standards prescribed for courses developed under the interagency curriculum established and coordinated by the National Wildfire Coordinating Group. The instruction is certified for interagency use and is known as:

Wildland Fire Chain Saws, S-212
Certified at Level I

This product is part of an established NWCG curriculum. It meets the requirements of the NWCG Curriculum Management Plan and has received a technical review and a professional edit.

NWCG Executive Board Chair

Date Dec 21, 2012

NWCG Training Branch Manager

Date Dec. 21, 2012

Wildland Fire Chain Saws

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Sponsored for National Wildfire Coordinating Group (NWCG) publication by the NWCG Operations and Workforce Development Committee.

Comments regarding the content of this publication should be directed to National Interagency Fire Center, NWCG Training Branch at BLM_FA_NWCG_Evaluation@blm.gov.

For additional copies of this publication, go to Products at www.nwcg.gov.

Previous editions: February 2004

NWCG OPERATIONS AND WORKFORCE DEVELOPMENT COMMITTEE
POSITION ON COURSE PRESENTATION AND MATERIALS

The recommended hours listed in the FMCG are developed by Subject Matter Experts based on their estimation of the time required to present all material needed to adequately teach the unit and course objectives. The hours listed may vary slightly due to factors such as number of students, types and complexity of course activities, and the addition of local materials.

NWCG does not approve of course delivery varying greatly from the recommended course hours. Instructors and students are cautioned that in order to be recognized as an NWCG-certified course, certain guidelines must be followed:

- Lead instructors are encouraged to enhance course materials to reflect the conditions, resources, and policies of the local unit and area as long as the objectives of the course and each unit are not compromised.
- Exercises can be modified to reflect local fuel types, resources, and conditions at the location where the student will likely fill incident assignments. The objectives and intent of the exercises must remain intact.
- Test questions may be added that reflect any local information that may have been added to the course. However, to ensure the accurate testing of course and unit objectives, test questions in the certified course materials should not be deleted.
- Test grades, used to determine successful completion of the course, shall be based only on the questions presented in the certified course materials.

If lead instructors feel that any course materials are inaccurate, information should be submitted either by accessing the online feedback form at training.nwcg.gov (select the "NWCG EVAL" button in the upper right corner) or by sending an email to the NWCG Training Branch at BLM_FA_NWCG_Evaluation@blm.gov. Materials submitted will be evaluated and, where and when appropriate, incorporated into the appropriate courses.

COURSE LENGTH FOR NWCG COURSES

Recommended course hours and the "NWCG Position on Course Presentation and Materials" above will be adhered to by the course instructors (see below for exception for criteria-based courses).

- Recommended unit times represent the allotted time to teach the unit and complete the exercises, simulations, and tests.
- Recommended course hours are provided to help the students and the course coordinator plan for travel, room reservations, and facilities usage. The recommended course hours represent the time estimated to present the NWCG-provided materials including time for breaks, lunch periods, to set up for field exercises or simulations, etc.
- Actual times for both the unit(s) and the course may vary based on number of students, types and complexity of course activities, and the addition of local instructional materials.

If the course is criteria based, e.g., L-380, and has been developed using NWCG course criteria, minimum course hour requirements have been established and must be adhered to by the course developer and course instructors.

Course hours for all NWCG courses can be found in the Field Manager's Course Guide at www.nwcg.gov/pms/training/training.htm. If the hours are a minimum versus recommended, they will be stated as such.

PREFACE

Wildland Fire Chain Saws, S-212, is a suggested National Wildfire Coordinating Group (NWCG) training course for individuals desiring to be qualified as a Firefighter Type 1 (FFT1), Incident Commander Type 5 (ICT5), or Felling Boss, Single Resource (FELB) in the National Interagency Incident Management System: Wildland Fire Qualification System Guide (PMS 310-1).

This course was developed by an interagency group of subject matter experts with direction and guidance from the NWCG Training Branch. The primary participants in this development effort were:

USDA FOREST SERVICE

Roland Rose – Columbia River Gorge National Scenic Area, Oregon

USDI NATIONAL PARK SERVICE

Jason Devcich – Wind Cave National Park, South Dakota

The NWCG Training Branch would also like to thank Bill Aaron, USDA Forest Service, Tahoe National Forest, Supervisor's Office, Tahoe, California; and many interagency subject matter experts.

The NWCG appreciates the efforts of these personnel and all those who have contributed to the development of this training product.

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Unit 3 – Fireline Construction and Mop Up 3.1

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APPENDIXES

The following appendixes are located on the Course Materials DVD:

Appendix A – Course Ordering and Support Information

Appendix B – PowerPoint Presentations

Appendix C – Student Assessment

Appendix D – Course Evaluation Forms

Appendix E – Advanced Chain Saw Tasks and Techniques (optional)

COURSE INSTRUCTIONS

This section contains instructions and information essential to the course coordinator and instructors (the cadre) in making an effective presentation. Cadre members must read this section and be thoroughly familiar with course procedures and material before presenting the course.

I. INTRODUCTION

Wildland Fire Chain Saws, S-212, is an instructor-led course that requires approximately 24–36 hours for presentation and is intended to be presented at the local level. This course is designed to support the training requirements of the Interagency Incident Management System: Wildland Fire Qualification System Guide (PMS 310-1). The course lessons provide introduction to the function, maintenance, and use of internal combustion engine-powered chain saws and their tactical wildland fire application. Field exercises support entry level training for firefighters with little or no previous experience in operating a chain saw by providing hands-on cutting experience in surroundings similar to fireline situations.

The PMS 310-1, developed under the sponsorship of the National Wildfire Coordinating Group (NWCG), is designed to establish minimum requirements for training, experience, physical fitness level, and currency standards for wildland fire positions, which all participating agencies have agreed to meet for national mobilization.

To ensure that the most up-to-date material is being presented, instructors are encouraged to refer to the NWCG Training and Qualifications website. This website contains current updates for all NWCG courses (go to http://training.nwcg.gov/).

II. COURSE OBJECTIVES

Course objectives are stated in broad terms that define what students will be able to accomplish after completing the course.

At the successful completion of this course, students will be able to:

- Define and apply chain saw safety standards as required by OSHA and agency handbooks, manuals, directives, and owner's manuals.

- Identify and demonstrate basic chain saw operation, troubleshooting, maintenance, and safety features.

- Demonstrate the tactical application of chain saws in fireline construction and mop up operations.

III. MINIMUM INSTRUCTOR QUALIFICATIONS

It is mandatory that all instructors be fully certified chain saw operators. The success of this course depends on the instructors' own chain saw operation skills, as well as their ability to articulate those skills to a diverse audience.

Instructor qualifications are agency determined.

Also see Instructor Certification in the NWCG Field Manager's Course Guide (PMS 901-1), online at http://training.nwcg.gov/.

Instructors are responsible for the presentation of their unit. Any additions or changes to the lesson outline should be discussed at the cadre meeting and approved by the lead instructor. Instructors have the responsibility to conduct the course in a safe manner and for ensuring that all agency and OSHA rules are obeyed. The lead instructor should be present at all classroom sessions and the field exercise.

All instructors for this course must meet the minimum standards for wildland fire training instructors established by the National Wildfire Coordinating Group (NWCG). A full explanation of these standards can be found in the NWCG Course Coordinator's Guide (PMS 907), online at http://training.nwcg.gov/. Lead instructors are required to have successfully completed a 32-hour instructor training course that emphasizes adult education teaching skills. The NWCG Facilitative Instructor, M-410, course is recommended. Unit instructors should have 32 hours of instructor training.

One evaluator is needed for each saw team during the field exercise.

IV. INSTRUCTOR PREPARATION AND COURSE COORDINATION

A. General Information

The Course Coordinator's Guide (PMS 907), online at http://training.nwcg.gov/, contains general information for presentation of NWCG courses. The course coordinator and instructors should be thoroughly familiar with this guide.

The material in this course is designed to be presented through a series of facilitated discussions, classroom instruction, and field exercises. Instructors must devote adequate time for their presentations, and should draw from their experiences to add realism and credibility to the information provided.

Instructors should emphasize local and regional chain saw operating procedures and tree species issues, specifically as they relate to hazards and safety.

B. Exercises and Other Pertinent Information

Successful course presentation requires students to complete a field exercise that includes substantial hands-on time operating a chain saw. A suitable field location must be located and approved well in advance of the course presentation date. The field location should be easily accessible, within reasonable driving distance and time from the classroom location (no more than 1 hour each way), and conform to agency use requirements. The area should be relatively flat, easily traversed on foot, and must offer enough standing live and dead trees, brush, and logs for the students to achieve the course objectives.

A Job Hazard Analysis (JHA) or Risk Assessment (RA) must be completed and approved for the field exercise site and provided to the faculty and students for class discussion before conducting the field exercise. Samples of the JHA and RA are in Unit 1 as IR 1-1, SR 1-1, IR 1-2, and SR 1-2.

C. Course Agenda

Sample agendas are on pages 13–16. Revise the agenda as appropriate. The agenda can be inserted into the Student Workbook before the beginning of class. Consider removing timeframes from the agenda you give to students.

The cadre has the latitude to rearrange the agenda to accommodate weather changes or travel times to the field exercise site, while ensuring all course objectives are met.

V. COURSE MATERIALS

The Course Materials DVD contains the Instructor Guide, Student Workbook, and Appendixes in bookmarked files in portable document format (PDF).

A. Instructor Guide

The Instructor Guide is designed as a teaching aid to assist instructors in presenting the course.

Each unit begins with a Unit Overview that outlines the lesson's approximate delivery time, objectives, learning strategy, instructional methods, required materials (instructional aids), and evaluation criteria.

The Unit Presentation follows the Unit Overview, and contains the lesson plan for each unit, shown in a two-column format:

- The Outline column contains the lesson content that supports the learning objectives. The column also contains notes to the instructor (directions for conducting an exercise, questions to ask students, etc.), which are in **bold boxes.**

- The Aids & Cues column lists references (slide numbers, handouts, publications, etc.) that remind instructors to display or refer to specific materials.

B. Appendixes

The following appendixes are on the Course Materials DVD:

- Appendix A – Course Ordering and Support Information

  This appendix tells you how to order required components of the course and what additional support materials are needed for course presentation.

- Appendix B – PowerPoint Presentations

  Test the equipment before the start of class to ensure compatibility with software.

  Refer to the READ ME file, located on the DVD, which provides information on:

  - Minimum System Requirements to Successfully Run Microsoft PowerPoint 2010 Presentations
  - Editing the original PowerPoint 2010 Files
  - Troubleshooting
  - Microsoft PowerPoint Viewer 2010
  - References on Creating PowerPoint Slides

- Appendix C – Student Assessment

  This appendix contains:

  - Unit Quizzes

    Must be printed and reproduced from these files to provide one copy for every student, as indicated in the unit.

- Unit Quiz Answer Keys

- Chain Saw Operator Field Evaluation Form

  Must be printed and reproduced from this file to provide one copy for every student, as indicated in the unit.

- Appendix D – Course Evaluation Forms

  The Student Training Course Evaluation Form allows the students an opportunity to comment on the course and the instructors for the purpose of improving future training sessions. Distribute the form to each student at the beginning or end of the course.

  The Training Course Evaluation Form is an opportunity for the course coordinator and instructors to comment on course design. These comments are used by NWCG Training to identify potential problems with courses and as a resource during the course revision process.

  The Online Course Evaluation Form also allows for feedback. Comments can also be submitted online at http://training.nwcg.gov by selecting the NWCG EVAL button in the upper right corner.

- Appendix E – Optional Course Materials

  This appendix contains supplemental course materials. It includes techniques that may be considered best used for more advanced students.

C. Student Materials

- One Student Workbook per student. In most cases, the Student Workbook contains the same course information as the Instructor Guide but without the instructor notes, aids and cues, and exercise answers. Student Workbooks should be ordered before the beginning of the course, one for each student, and

each student should receive this guide upon arrival at the training session.

- Each student is required to bring full fireline Personal Protective Equipment (PPE) and approved chain saw chaps and hearing and eye protection.

- No less than one chain saw for every three students. Instructors are encouraged to require students to bring a properly functioning chain saw equipped with a 16- to 24-inch guide bar from their home unit to the course to use during the classroom and field exercises. Additional chain saws should be readily available onsite to replace any saws that are removed from service.

  The NFES 0340 Chain Saw Kit or equivalent should be available or ordered for student inspection.

- One chain saw tool kit for each saw. Refer to NFES 0342 for minimum tool kit contents. Each student is encouraged to bring an Owner's Manual and complete tool kit appropriate for the chain saw selected, a felling axe, and wedges to the course. Refer to Appendix A in the Instructor Guide for a complete tool kit list.

D. Instructional Media Equipment

Instructional media equipment provided for the instructors should include:

- Computer, projector, and screen
- White board with markers and eraser
- Easel with extra flip chart pads and markers

VI. STUDENT TARGET GROUP

The target group should consist of individuals desiring to be qualified as Firefighter Type 1 (FFT1), Incident Commander Type 5 (ICT5), or Felling Boss, Single Resource (FELB).

This course is suggested training for individuals who use chain saws in their NWCG wildland firefighting positions. It provides basic instruction in chain saw use for tactical fireline applications.

VII. COURSE PREREQUISITES

Refer to the Field Manager's Course Guide (PMS 901-1) for current course prerequisites.

For additional training that supports development of knowledge and skills, refer to the PMS 310-1.

VIII. PRE-SELECTION ASSESSMENT AND PRE-COURSE WORK

The pre-course materials are located online at http://training.nwcg.gov.

The course coordinator can provide the pre-course glossary to the students by referring nominees to the online pre-course glossary; list the website in the nomination or selection letter (http://training.nwcg.gov). Students should receive pre-course glossary information at least 2 weeks before beginning the course.

The pre-course glossary will take approximately 1 hour to read. The intent of the glossary is to familiarize students with new or unfamiliar terminology. Students should be encouraged to read the glossary before the beginning of the class start time on the first day.

IX. COURSE SELECTION LETTER

Send a course selection letter, along with the pre-course glossary information, to students at least 6 weeks before the course begins. The letter should instruct students to bring the glossary to the course. An example course selection letter is located on pages 11–12.

X. CADRE MEETINGS

Cadre meetings are an opportunity for instructors to meet, review the material, and discuss concerns with the course coordinator or lead instructor. The meetings are critical for instructors who do not have previous experience with the course. A cadre meeting checklist is located in the Course Coordinator's Guide (PMS 907).

A cadre meeting before each day's course presentation is recommended because of the interrelationship of the unit material (changing instructional materials in one unit may impact a later unit).

After each day's presentation, hold a cadre meeting to discuss concerns and progress. At the end of the course, conduct a final cadre meeting to evaluate instructor performance and suggest modifications for future courses.

XI. RECOMMENDED CLASS SIZE

Because of the logistics and safety concerns associated with the field exercise, class size should be limited to no more than 21 students.

XII. SPACE AND CLASSROOM REQUIREMENTS

The characteristics of the classroom and supportive facilities have a significant impact on the learning environment. The classroom should be chosen and viewed well in advance of the presentation.

The following characteristics should be considered when choosing a location and classroom:

- Ideally, the main classroom should be approximately 30 by 40 feet. This will allow tables to be situated in a way that provides adequate workspace for the students and to accommodate instructors and equipment needs. Supportive facilities such as break areas, restrooms, etc., should be provided.

- Have an outdoor area to start chain saws, and if practical, practice cutting of logs.

- The classroom should be free from outside interruptions and interferences.

- The classroom should have controlled lighting, good acoustics, and good ventilation.

- Provide adequate access to copy and printing services.

- Provide adequate desk space and power outlets for laptop computers (one power strip for each table).

- Be sure a computer with projector and screen is available to show electronic presentations.

- If printing in the classroom, a laptop and driver for the printer will be needed.

Refer to the Course Coordinator's Guide (PMS 907) for more information.

XIII. STUDENT ASSESSMENT AND CERTIFICATION

Students must obtain a passing score to receive a certificate of completion for the course. This course consists of a series of unit presentations, classroom exercises, and a field exercise. Quizzes will be given for Units 1, 2, 3, 4A, and 4C. Quizzes and answer keys are located in Appendix C. Quizzes must be passed with a score of 70 percent or higher. The field exercise elements will be graded by an instructor/evaluator using the S-212 Chain Saw Operator Field Evaluation Form (in Appendix C), discussed with and signed by the students. Students will be graded on the classroom exercises and quizzes and the field exercise to determine whether they pass or fail.

Copies of each student's final grade and field evaluation forms will be forwarded to their respective supervisors by the lead instructor.

Wildland Fire Chain Saws, S-212
Sample Course Selection Letter

To: *Student's Name*

From: *Course Coordinator's Name*

Subject: Wildland Fire Chain Saws, S-212

Congratulations, you have been selected to attend Wildland Fire Chain Saws, S-212, to be held at *(location).* The course will begin promptly at *(time and date)* and end at *(time and date).*

The instruction in the S-212 course will assume you have a command of the information taught in the prerequisite courses (L-180, S-130, S-190) and at least 1 year of experience in wildland fire to provide knowledge of fireline tactics, LCES, communication, and chain of command.

The pre-course glossary for S-212, located online at http://training.nwcg.gov, is designed to acquaint you with the terms used in professional chain saw operations. The descriptions and illustrations will help you prepare for successfully completing the course lessons.

You are required to bring the following items to the course:

- Incident Response Pocket Guide
- Complete fireline personal protective equipment (PPE)

NOTE: THE FOLLOWING ARE OPTIONAL

- A chain saw equipped with a 16- to 24-inch guide bar in good working condition.
- A chain saw tool kit and owner's manual for the chain saw noted above.
- A 3- to 5-pound felling axe, wedges, and wedge pouch.

If you wish to receive a certificate of completion for the course, please do not make travel arrangements to arrive after the scheduled start time or to depart before the scheduled course completion time.

In the event you cannot attend the course, please contact the course coordinator before the beginning of the class. This allows time for notifying students who may be on the waiting list to fill the vacancy.

If you have any questions please contact the course coordinator, *Name, at phone number, or email address*.

Wildland Fire Chain Saws, S-212

*Sample Agenda **#1***

This agenda allows students to develop skills with handling, bucking, limbing, and brushing and slashing before moving on to the felling content. This is the preferred agenda; however, there is an alternate agenda starting on page 15 in which the bucking and felling portions are not split. Times will vary depending on class size; more field time may be necessary.

MONDAY

1000	Unit 0 – Introduction	1 hour
1030	Unit 1 – Safety Requirements	2 hours
1230	Lunch	
1300	Unit 2 – Chain Saw Parts, Maintenance, and Operation	4 hours
1700	End of Day 1	

TUESDAY

0800	Unit 3 – Fireline Construction and Mop Up	1½ hours
0930	Unit 4A – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (in the classroom)	2 hours
1130	Unit 4B – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (Field Proficiency – introduction, in the classroom)	30 minutes
1200	Lunch	
1300	Unit 4B – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (Field Proficiency – in the field)	4 hours
1700	End of Day 2	

(Continued on next page.)

Sample Agenda #1 (cont.)

WEDNESDAY

0800 Unit 4C – Chain Saw Tasks and Techniques: Felling (in the classroom).....3 hours

NOTE: The final course objectives must be covered before the students leave the classroom for the field exercise.

1100 Unit 4D – Chain Saw Tasks and Techniques: Felling (Field Proficiency – introduction, in the classroom) .....30 minutes
1130 Unit 4D (continued) – Chain Saw Tasks and Techniques: Felling (Field Proficiency – in the field)..... 1 hour
1230 Lunch in the field
1300 Unit 4D (continued) – Chain Saw Tasks and Techniques: Felling (Field Proficiency – in the field).....4 hours
1700 End of Day 3

THURSDAY

0800 Field time .....4 hours
1200 Lunch in field
1230 Field time (continued).....3 hours
1530 Close-out ..... 1 hour
1630 End of Day 4

Total hours for the course: 24–36

Wildland Fire Chain Saws, S-212
*Sample Agenda **#2***

If logistics make separating the field exercises into two segments difficult, this agenda may be used as an alternate. However, if this alternate agenda is used, pay close attention to the unit numbers. Before allowing students to depart for field exercises, both Units 4B and 4D (classroom introductions to the field exercises) must be covered. Times will vary depending on class size; more field time may be necessary.

MONDAY

1000	Unit 0 – Introduction	1 hour
1030	Unit 1 – Safety Requirements	2 hours
1230	Lunch	
1300	Unit 2 – Chain Saw Parts, Maintenance, and Operation	4 hours
1700	End of Day 1	

TUESDAY

0800	Unit 3 – Fireline Construction and Mop Up	1½ hours
0930	Unit 4A – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (in the classroom)	2 hours
1130	Lunch	
1230	Unit 4C – Chain Saw Tasks and Techniques: Felling (in the classroom)	3 hours
1530	Unit 4B – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (Field Proficiency – introduction, in the classroom)	30 minutes
1600	Unit 4D – Chain Saw Tasks and Techniques: Felling (Field Proficiency – introduction, in the classroom)	30 minutes
1630	End of Day 2	

(Continued on next page.)

Sample Agenda #2 (cont.)

WEDNESDAY

0800 Unit 4B and 4D combined:
- Unit 4B – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (Field Proficiency – in the field)
- Unit 4D – Chain Saw Tasks and Techniques: Felling (Field Proficiency – in the field) .....4 hours

1200 Lunch in the field

1230 Unit 4B and 4D combined (continued):
- Unit 4B – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (Field Proficiency – in the field)
- Unit 4D – Chain Saw Tasks and Techniques: Felling (Field Proficiency – in the field) .....4 hours

1630 End of Day 3

THURSDAY

0800 Field time .....4 hours

1200 Lunch in the field

1230 Field time (continued).....3 hours

1530 Close-out ..... 1 hour

1630 End of Day 4

Total hours for the course: 24–36

UNIT OVERVIEW

Course Wildland Fire Chain Saws, S-212

Unit 0 – Introduction

Time 1 hour

Objectives

1. Introduce instructors and students.
2. Discuss administrative requirements of the course.
3. Review roles and responsibilities for chain saw operations.
4. Review pre-course material.

Strategy

This unit is an introduction to the course. It involves student and cadre interaction through introductions.

Instructional Method(s)

- Informal lecture and discussion with PowerPoint presentation

Instructional Aids

□ Computer with LCD projector, presentation software, and screen

Exercise(s)

- None

Evaluation Method(s)

- None

Outline

I. Introduction

II. Administrative Requirements

III. Roles and Responsibilities Within the Chain Saw Program

IV. Pre-course Review

Aids and Cues Codes

The codes in the Aids and Cues column are defined as follows:

IG – Instructor Guide	IR – Instructor Reference
SW – Student Workbook	SR – Student Reference
HO – Handout	Slide – PowerPoint

UNIT PRESENTATION

Course Wildland Fire Chain Saws, S-212

Unit 0 – Introduction

OUTLINE	AIDS & CUES
Present NWCG Mission Statement slide.	Slide 0-1
Present course and unit title slide.	Slide 0-2
Present unit objectives.	Slide 0-3
I. INTRODUCTION	Slide 0-4
A. Welcome	
B. Introduce Instructors and Students	
C. Course Administration	Slide 0-5
1. Breaks, snacks, drinking fountains, punctuality	
2. Smoking policy	
3. Location of restrooms and vending machines	
4. Other local information (restaurant locations, local map)	
5. Transportation	
6. Cell phones	

OUTLINE	AIDS & CUES
II. ADMINISTRATIVE REQUIREMENTS	
A. Course Objectives At the completion of the S-212 Wildland Fire Chain Saws course, the student will be able to: • Define and apply chain saw safety standards as required by OSHA and agency handbooks, manuals, directives, and owner's manuals. • Identify and demonstrate basic chain saw operation, troubleshooting, maintenance, and safety features. • Demonstrate the tactical application of chain saws in the fireline construction and mop up operations.	Slide 0-6 Slide 0-7
B. Student Evaluation The course has three methods of student evaluation: • Instructor evaluation based on participation • Unit quizzes • Field exercises All of the above methods will count toward the final grade.	Slide 0-8

OUTLINE	AIDS & CUES
Each unit has exercises, discussion, or both. The instructor will evaluate the individual students while they participate as part of the group and work through the exercises.	
C. Performance-Based Training System	Slide 0-9
This course prepares the student to perform low complexity project and fireline tasks under the supervision of a fully qualified trainer.	
The trainer provides additional on-the-job training and mentoring to develop the trainee's skills and proficiency.	
This course will provide the basic skills required by NWCG member agencies for using chain saws safely.	
This wildland fire chain saw program was developed to provide new sawyers with a solid foundation for safe and efficient chain saw handling and operation while bucking, limbing, brushing and slashing, and felling for project work or fireline construction.	
The student's final certification will be accomplished according to their employing agency's standards. An evaluator will assess the trainee's skill level after practice for applicable position task books and certification.	Slide 0-10

OUTLINE	AIDS & CUES
Safety is the most critical objective of this course. Your safety, the safety of your coworkers, the safety of the public, and property protection should be a part of every plan and every action you take. Careful study and practice of chain saw operations will improve your own abilities and help you identify your limitations to ensure safe saw operation. Many agency employees will never achieve the skills and experience of a professional, year-round sawyer. In addition, many agency sawyers saw only during the short summer season, with long layoffs over the winter. Their skills and habits become rusty. An objective self-appraisal and refresher is appropriate.	
Explain how the Chain Saw Operator Field Evaluation Form located in Appendix C will be used for documenting student field exercise performance and as a basis for red card certification.	Slide 0-11
Inform students that while completing the course they will be evaluated in the classroom and in the field as they demonstrate their judgment, knowledge, skills, and abilities for possible certification and to determine any additional training needs.	

OUTLINE	AIDS & CUES
Briefly describe the certification levels for sawyers and the details of restrictions or endorsements for special uses.	Slide 0-12
Although there are benchmark skill levels of sawyers, the complexity of the assignment goes beyond tree size.	
III. ROLES AND RESPONSIBILITIES WITHIN THE CHAIN SAW PROGRAM	Slide 0-13
As the chain saw operator, you must be aware of government regulations and agency standards that are required to be met before you operate a chain saw. You are part of a larger organization and will work with the following people:	Slide 0-14
Coach/Trainer – mentors and trains apprentice sawyers	
Supervisor – facilitates training, gives assignments, ensures that documentation is appropriate, and reports accidents	
Evaluator – assesses operator skill level and makes recommendation for certification	Slide 0-15
Certifier – has signatory authority, for example, the line officer, District Manager, Park Superintendent, etc.	

OUTLINE	AIDS & CUES
IV. PRE-COURSE REVIEW	
Review the pre-course work (course glossary), and answer any questions the students may have on concepts or definitions.	Slide 0-16 through Slide 0-34
Review unit objectives.	Slide 0-35

UNIT OVERVIEW

Course Wildland Fire Chain Saws, S-212

Unit 1 – Safety Requirements

Time 2 hours

Objectives

1. Identify sources of information for chain saw regulations and standards.
2. Describe the elements of a Job Hazard Analysis/Risk Assessment required for chain saw operations.
3. Define the Personal Protective Equipment required for chain saw operations.
4. Identify the safety components of the Situational Awareness and Individual Complexity List.

Strategy

This unit serves as an introduction to safety as it pertains to chain saws. There are discussion topics, scenarios, and exercises to help students remember key safety topics. Students will review slides to identify safety infractions, list hazards connected to various sawyer tasks, and discuss agency policy. They will discuss complexity versus size and go through scenarios on leadership.

Instructional Method(s)

- Informal lecture with PowerPoint presentation and interactive discussion

Instructional Aids

□ Computer with LCD projector, presentation software, and screen

Exercise(s)

- Complexity Versus Size

Evaluation Method(s)

- Unit quiz

Outline

I. Regulations and Standards

II. Job Hazard Analysis/Risk Assessment

III. Situational Awareness and Complexity

Aids and Cues Codes

The codes in the Aids and Cues column are defined as follows:

IG – Instructor Guide	IR – Instructor Reference
SW – Student Workbook	SR – Student Reference
HO – Handout	Slide – PowerPoint

UNIT PRESENTATION

Course Wildland Fire Chain Saws, S-212

Unit 1 – Safety Requirements

OUTLINE	AIDS & CUES
Present unit title slide. **Present unit objectives.**	Slide 1-1 Slide 1-2 Slide 1-3 Slide 1-4
I. REGULATIONS AND STANDARDS	
• **Provide a brief review of the Federal laws and agency safety standards that we work under.** • **Briefly discuss that different agencies have different safety regulations based on their policy requirements.** • **Direct students to applicable agency policy manuals. Students must be aware of all laws and standards before operating a chain saw.**	
• Occupational Safety and Health Administration (OSHA) regulations may apply to certain students. See OSHA 29 CFR 1910 logging operations, specifically training, documentation, and certification (1910.266[i]). • The following OSHA site contains much useful information: http://www.osha.gov/SLTC/etools/logging/.	

OUTLINE	AIDS & CUES
Obtain regional and agency accident statistics from the respective safety managers. This information will show the areas that need to be emphasized during safety training for your local saw training and certification program.	
For specific references to agency manuals, refer to the following:	
U.S. Forest Service (USFS) students, refer to the USFS Health and Safety Code Handbook, FSH 6709.11.	Slide 1-5
Bureau of Indian Affairs (BIA) students, refer to the Wildland Fire and Aviation Program Management and Operations Guide.	Slide 1-6
U.S. Fish and Wildlife Service (USFWS) students, refer to Service Manual 241fw7.38(7) and (7.4c).	Slide 1-7
For general Federal interagency reference, Bureau of Land Management (BLM) and National Park Service (NPS) students can refer to Interagency Standards for Fire and Fire Aviation Operations, the Wildland Fire Incident Management Field Guide (PMS 410-1), and the Incident Response Pocket Guide.	Slide 1-8

OUTLINE	AIDS & CUES
II. JOB HAZARD ANALYSIS/ RISK ASSESSMENT	
Inform students that, depending on their agency, they will use either a Job Hazard Analysis (JHA) or a Risk Assessment (RA).	Slide 1-9
A Job Hazard Analysis (JHA) or Risk Assessment (RA) describes the potential hazards of the worksite, along with all agency policies, controls, and work practices selected to minimize those hazards.	Slide 1-10 through Slide 1-12 IR 1-1 SR 1-1, Student Workbook, pages 1-29 through 1-34
A JHA/RA must be prepared (preferably with the assistance of the involved employees) before beginning any work project or activity. The RA has a scoring element that defines who has signature authority. With a JHA, agency policy dictates who has signature authority.	IR 1-2 SR 1-2, Student Workbook, page 1.35
To use a JHA, the job leader and supervisor reviews hazards and mitigations, adds additional ones if applicable, and then signs off that they are in agreement. A JHA should be prepared ahead of time and reviewed and signed by operators just before implementation.	Slide 1-13
To use an RA, the job leader or supervisor reviews hazards and mitigations, and then determines the appropriate signature authority.	

OUTLINE	AIDS & CUES
• **Hand out local JHA/RA for the field exercise area for student review and signature.** • **Briefly review process and elements using the following material in sections A-G.** • **Stress the importance of safe work behavior.** • **Complete JHA/RA with signature or additions.**	Slide 1-14
Both the JHA and the RA will cover the following material:	Slide 1-15
A. Task or Procedure To Be Accomplished Such tasks could include limbing, bucking, or felling.	
B. Hazards Associated With the Task or Procedure On wildfires, we use the Incident Response Pocket Guide Risk Management Process to identify and mitigate hazards. These hazards may include the following: 1. Physical hazards: Rocky terrain, slippery slopes, fire, power lines 2. Biological hazards: Insect bites, hantavirus, snakes, blastomycosis, lyme disease 3. Environmental hazards: Weather-related hazards such as hyperthermia, wind, lightning	

OUTLINE	AIDS & CUES

4. Chemical hazards: Hazardous materials, such as fuel mix for chain saws, or bar oil

5. Other hazards: Personal security issues, public traffic, hunting seasons, structures

C. Abatement Actions That Can Eliminate or Reduce Hazards

Abatement actions include:

1. Engineering controls: The most desirable method of abatement, such as the chain brake built into the chain saw that reduces injury from saw kickback

2. Substitution: Such as switching to high flashpoint or using nontoxic solvents

3. Administrative controls: Such as limiting exposure by reducing work schedules or establishing appropriate work practices and procedures

4. Personal Protective Equipment (PPE): The method that must always be used, such as using eye and hearing protection when working with chain saws

OUTLINE	AIDS & CUES

D. Emergency Evacuation Procedures

In the event of an emergency evacuation, be prepared to provide the following information:

1. Nature of the accident or injury (avoid using the victim's name)
2. Type of assistance needed (ground, air, or water evacuation)
3. Location where the accident occurred and best access to the work site (road name or number).
4. Radio frequencies and/or phone numbers
5. Contact person
6. Local hazards to ground vehicles or aviation
7. Weather conditions (windspeed and direction, visibility, and temperature)
8. Topography
9. Number of individuals to be transported
10. Estimated weight of individuals for air evacuation

OUTLINE	AIDS & CUES
Discuss with the students how a medical emergency during the field exercise will be handled, everyone's role, and the emergency evacuation procedure.	Slide 1-16
E. First Aid The onsite first-aid kit must have supplies that meet Occupational Safety and Health Administration (OSHA) specifications and requirements. A Type IV (10-person) first-aid kit must be available as a minimum (General Services Administration national stock number NSN 6545-01-010-7754). A more complete kit that meets higher standards may be used. In addition to the basic kit, additional trauma dressings, a survival (space) blanket, and non-latex surgical gloves should be added.	Slide 1-17 through Slide 1-20
Discuss with the students why an emergency evacuation plan is important.	
F. Emergency Evacuation Plan An emergency evacuation plan is essential for any field project, especially one involving chain saws. All employees must: 1. Know which frequencies and phone numbers to use and whom to contact in the event of an emergency.	Slide 1-21

OUTLINE	AIDS & CUES
2. Know the latitude and longitude (preferred) and/or the legal description for an emergency medical helispot. The entire crew shall know where the helispot is located. 3. Be aware of updates to the emergency evacuation plan. The emergency evacuation plan needs to be updated when the work location changes. 4. Ensure that vehicle egress is not blocked by activities and that vehicles identified for evacuation are parked headed out. 5. Understand the JHA/RA. The JHA/RA and emergency evacuation plan shall be signed by employees, signifying that they: • have read and understood the contents • have received the required training • are qualified to perform the task or procedure • will comply with all safety procedures	

OUTLINE	AIDS & CUES

6. Have required documents onsite. Copies of the following must be kept onsite during the project:

   - JHA/RA.
   - The bloodborne-pathogen exposure control plan.
   - The Material Safety Data Sheets (MSDS) for products used on the work project or activity.
   - The emergency evacuation plan.
   - The JHA/RA can be reviewed and updated during tailgate safety briefing and debriefing sessions.

Relate to the students how the Incident Action Plan on Type 3 and larger incidents provides:

- **The equivalent of a JHA/RA with medical emergency**
- **Evacuation**
- **Hazard identification**
- **Safety procedures**

Reference the required:

- **PPE for chain saw operations in the Firefighting Safety chapter of the Wildland Fire Incident Management Field Guide**
- **Incident Response Pocket Guide**
- **Standards for Fire and Aviation Operations**

OUTLINE	AIDS & CUES
G. Personal Protective Equipment (PPE) Required for Chain Saw Operations	Slide 1-22
1. Items that must be included in the JHA/RA:	
• Hardhat (full brim or cap style) – approved by the National Fire Protection Association (NFPA), 1977–1998.	Slide 1-23
All wildland fire hardhats are designed to provide protection from impact and penetration hazards from falling objects.	
Inspect helmet shells daily for signs of dents, cracks, penetration, or any other damage that might compromise protection.	
Suspension systems, headbands, sweatbands, and any accessories should also be inspected daily.	
• Wrap-around eye protection (safety glasses or shield) – approved by the American National Standards Institute (ANSI).	Slide 1-24

OUTLINE	AIDS & CUES
• Foot protection – footwear designed to prevent injury due to falling or rolling objects and objects piercing the soles. – Heavy-duty, 8-inch-high, laced, water-resistant leather boots that are cut-resistant, with ankle support and non-slip soles, appropriate for the weather conditions.	Slide 1-25
• Gloves (slip- and cut-resistant and appropriate for the weather conditions).	Slide 1-26
• Hearing protection (plugs or muffs) – approved for 85 decibels [dB] and higher; chain saw produces 110−120 dB.	
• Protective clothing: – Long-sleeved shirt appropriate for the weather conditions. – Pants (loose fitting and long enough to cover boot tops). Do not cut (stag) fire pants to shorten them.	

OUTLINE	AIDS & CUES

  - No loose clothing or accessories that could become entangled in the saw (belt ends, untucked shirts, shoe laces, etc.).

- Approved chain saw chaps – chaps should overlap boot tops by at least 2 inches. Chaps must meet Missoula Testing and Development Center (MTDC) specifications. For more information about chain saw chaps, see number 3 below.

- Additional protection: Saw shoulder pads or other PPE that provide cut resistance or puncture protection.

- Bar cover.

- Fire shelter (for fireline operations).

- Appropriate first-aid kit. Employees should carry their own surgical gloves. Additional trauma pads are recommended.

- Whistle or other signaling device. Safety whistle should be attached in a manner that allows it to easily reach your mouth in an emergency.

OUTLINE	AIDS & CUES

2. General PPE requirements

   a. Select PPE based on hazards identified in the JHA/RA.

      - PPE shall fit properly.
      - Defective, damaged, or unsanitary PPE shall not be used.
      - Supervisors shall ensure the adequacy of PPE as well as its proper maintenance and sanitation.

   b. Each employee shall be trained to wear the PPE required by the JHA/RA. Training shall include:

      - The required PPE and when and how it should be worn.
      - Proper care, maintenance, useful life, limitations, and disposal of PPE.

   c. Employees need to demonstrate an understanding of their training in proper use of PPE.

OUTLINE	AIDS & CUES
Employees may be held accountable with personnel actions for accidents and injuries that result from failing to use, or misusing, required PPE.	
Instructor will demonstrate proper use and discuss application of each item of PPE.	Slide 1-27 Slide 1-28 Slide 1-29 (video)
3. Chain saw chaps	
a. How chain saw chaps protect the user A back-coated nylon shell covers the Kevlar protective pad inside the chaps. The shell resists water, oil, and abrasions. The protective pad consists of five layers of Kevlar. Kevlar is an aramid fiber similar to the Nomex material used in firefighter's clothing. When a saw chain strikes chain saw chaps, Kevlar fibers first resist the cut, then are pulled into the chain saw's drive sprocket, slowing and quickly stopping the chain (approximately 5 seconds or less). If the chap surface or pad is cut, it cuts the Kevlar fibers.	

OUTLINE		AIDS & CUES
	If another cut occurs, it will only pull out the Kevlar strands that have been previously damaged, resulting in increased chance of injury. Chaps are only sewn along the edges to ensure the maximum amount of fabric will pull out to clog the chain and sprocket. When chain saw chaps are exposed to temperatures higher than 500 degrees Fahrenheit, the nylon shell may melt, but the protective Kevlar pad will not burn. Chain saw chaps need to be properly adjusted and worn snug to keep them positioned correctly. Proper fit and correct length (at least 2 inches below the boot top) maximize protection.	
b.	Chain saw chaps specifications See NFPA 1977, USFS Spec-6170-4F, for chain saw chaps specifications. The Forest Service has provided cut-resistant protective chaps for chain saw users since 1965. Chain saw chaps have prevented thousands of serious injuries.	Slide 1-30

OUTLINE	AIDS & CUES
The Missoula Testing and Development Center (MTDC) monitors chain saw injuries. Because chain saws require right-hand operation, the majority of chain contact injuries occur on the left leg. The current specification (6170-4F) provides a higher level of protection or cut resistance of up to 3,200 feet per minute (fpm) chain speed. Chaps meeting USFS specification 6170-4F are either green or orange in fabric color, have leg width of at least 14 inches, black-colored webbing and trim, and are labeled with specification number 6170-4F. Only saw chaps provided by the General Services Administration meeting MTDC specifications 6170-4F are approved for Federal agency purchase and use.	

OUTLINE	AIDS & CUES
c. Inspection and replacement Chain saw chaps need to be inspected and replaced when appropriate. Replace chain saw chaps when: • The outer shell has numerous holes and cuts. Holes in the outer shell allow bar oil to be deposited on the protective pad. The oil acts as an adhesive, preventing fibers in the pad from moving freely, decreasing protection. Holes and cuts are indicators of near misses or improper use. Never allow a moving chain to touch the chaps. • Wood chips and sawdust are evident in the bottom of the chaps. • Cleaning has been improper. Detergents with bleach additives decrease protection by compromising fiber integrity. **Do not bleach.**	Slide 1-31

OUTLINE	AIDS & CUES
• High-pressure or machine washing has destroyed the protective pad. • The chaps have a cut in the first layer of yellow Kevlar that is more than 1-inch long.	
Refer to Redbook chapter on safety (http://www.nifc.gov/policies/pol_ref_redbook_2012.html).	
d. Caring for chain saw chaps	
Refer students to Care and Cleaning of Chain Saw Chaps.	IR 1-3 SR 1-3, Student Workbook, pages 1.37–1.39
Treat your chain saw chaps as a CRITICAL piece of safety equipment. Keep them as clean as possible. Appropriate and timely cleaning reduces the flammability of the chaps and keeps your clothing cleaner. **Do not use your chaps as a chain stop.** Do not wrap chaps around the bar of the saw during storage or transport. Chaps can be damaged after contact with bar oil.	

OUTLINE	AIDS & CUES
Clean and repair chain saw chaps according to manufacturer's instructions.	
III. SITUATIONAL AWARENESS AND COMPLEXITY	Slide 1-32
Introduce the Situational Awareness and Individual Complexity List. **The information on the list is critical to keep in mind during every chain saw operation.**	IR 1-4 SR 1-4, Student Workbook, pages 1.41–1.42
The Situational Awareness and Individual Complexity List can be used for self-assessment during sawing operations. It can also be used for discussions, tailgate safety sessions, or one-on-one problem solving (performance or skill deficiency) in the field.	
Emphasize that most evaluators will use this criteria during the certification process.	
A. Safety Considerations and Attitude	
• How do I feel about this sawing assignment?	
• Am I exercising sound judgment and awareness?	
• Is my attitude influencing me to go against my better judgment (gut feeling)?	
• Is my mind on my work project or activity?	

OUTLINE	AIDS & CUES
• Do I have self-confidence? • Am I overconfident? • Am I doing this against my will? • Is peer pressure a factor? • Am I professional enough to decline the assignment and ask for assistance? • Do I have all of the required PPE and sawing equipment to do the job safely? Am I committed to using the PPE and equipment correctly? • Am I complacent—unconcerned about potential danger? • Am I violating any safe operating procedures? • Do I feel hurried or unusually stressed to get the tree on the ground or bucked? • Have all options been considered and discussed with others? • Am I in an unfamiliar environment and timber type? • Do I watch out for my coworkers and the public?	

OUTLINE	AIDS & CUES
B. Evaluating the Complexity of the Assignment The individual sawyer must determine the complexity of the assignment. Your evaluation of the complexity of the assignment must be based on your individual skill, knowledge, and your understanding of your personal capabilities and limitations. The final decision to cut any tree is left up to the individual sawyer. You have the responsibility to refuse the assignment and walk away from any sawing situation that is beyond your capabilities. If a thorough job of assessing the complexity of the individual situation has been completed, the decision to cut or not to cut will be determined by the Go/No-Go process. **Tell students you will be discussing the Go/No-Go process later in this unit.**	Slide 1-33

OUTLINE	AIDS & CUES

You must be able to say the following:

"I feel comfortable with the sawing situation; I will cut it" or "I don't feel comfortable with the situation; I will walk away from it." Do not base your decision on the idea that, "I <u>think</u> I can do it."

1. Physical considerations:

    - General health
    - Physical conditioning
    - On medication or using any recreational substance?
    - Fatigue (can affect good judgment)
    - Time of day
    - Work-rest cycles
    - Dehydration

2. Environmental considerations:

    - Light conditions
    - Rain, fog, or snow
    - Smoke or dust
    - Wind direction and speed
    - Insect damage
    - Heat or cold
    - Tree spacing

OUTLINE	AIDS & CUES
3. Escape routes and safe zones	
• **Define safe zone for the students.** • **A <u>safe zone</u> is an area where you are clear from any adverse effects potentially encountered during a chain saw operation.** • **Versus a <u>safety zone</u>, which is an area where firefighters can survive without a fire shelter.**	Slide 1-34
When determining escape routes and safe zones: • Walk out and thoroughly check the intended lay or bed of the tree. Look for dead treetops, snags, and widow-makers that may cause kickbacks or result in another tree or limb becoming a hazard. • The primary escape route and alternates must be a predetermined path along which the faller proceeds once the tree is committed to the fall or to the bucking cut. • Safe zones should be no less than 20 feet from the stump. • Stand behind another tree (sound and of sufficient size to give protection), watching for whiplash, broken tree parts, etc.	Slide 1-35

OUTLINE	AIDS & CUES
• When felling, escape routes and safe zones should be 45 degrees to the sides and back from the direction of fall. • Sawyers must select and prepare the work area and clear escape routes and alternate escape routes before starting the first cut. • Although there can be two identified escape routes, there should be a clearly identified primary escape route where all the cutting is done. This prevents the faller from crossing behind or in front of the tree, which exposes them to greater risks.	
• **Have students close their Student Workbook.** • **Have students list five potential hazards encountered for each of the following operations:** – **Limbing** – **Bucking** – **Felling** • **Instructor will cover any additional remaining hazards.**	Slide 1-36

OUTLINE	AIDS & CUES
• **Use the following slides as an interactive discussion with the students, covering situational awareness in limbing, bucking, and felling.** • **Have students identify specific safety infractions.** • **Stress that these are common mistakes.** • **You may add applicable local slides.** • **The Situational Awareness and Individual Complexity List may be used to generate discussion.** • **Detailed discussion of the individual complexity elements will be covered in Unit 4C and should be left for that unit.**	Slide 1-37
4. Limbing Safety Before limbing, examine the tree or log and the immediate area for: • Overhead and ground hazards • Escape routes and safe zones • Steepness of terrain (percent slope) • Cutting area control • Limbs under tension • Spring poles	Slide 1-38 through Slide 1-41

OUTLINE	AIDS & CUES
• Is the log suspended off the ground? • Did the log move forward off the stump, causing the limbs to flex back when cut? • Did the tree twist or roll, causing limbs on one side of the tree to flex up toward the sawyer when cut? • Cut close to the bole. • Keep power head below shoulder height. • Use guide bar nose with caution to avoid kickback.	
5. Bucking Safety Examine the log and immediate area for: • Percent of ground slope or incline • Potential for log to roll, slide, or bind • Tension and compression • Rocks and foreign objects on or under log	Slide 1-42 through Slide 1-47

OUTLINE	AIDS & CUES
• People and property in cutting zone or below • Fire • Root wads • Rocks or other items the tree may dislodge • Overhead hazards • Spring poles • Never buck a tree that is considered unusually dangerous. • Is guide bar length adequate for the tree to be bucked apart completely? • Can the log be bucked from two sides or the uphill side safely? • Establish good footing, and swamp out bucking areas and escape route. • Select bucking cut carefully. • Anticipate log's reaction when severed.	

OUTLINE	AIDS & CUES
6. Felling Safety	Slide 1-48 through Slide 1-53

Be prepared to discuss your agency policy about having an assistant at the stump during the back cut.

Examine immediate work area for:

- Overhead hazards
- People (i.e., swamper and/or members of public and other crews)
- Roads and/or vehicles
- Power lines or fences
- Hangups
- Consider reaction of other trees
- Other trees that may have to be felled first
- Nearby hazards such as trees, rocks, brush, and low-hanging limbs
- Structures
- Openings to fell trees
- Snags

OUTLINE	AIDS & CUES
• Fire-weakened trees • Widow-makers Examine surrounding terrain for: • Steepness of ground • Irregularities in the ground • Draws and ridges • Rocks • Stumps • Loose logs • Ground debris that can "fly" back or kick up at the sawyer Analyze the felling job by considering: • Tree species and whether live or dead • Diameter and height • Soundness and defects • Twin tops or school marm • Widow-makers and hangups • Heavy branches and weight distribution	

OUTLINE	AIDS & CUES
• Burning top • Spike top • Splits and frost cracks • Deformities such as mistletoe • Damage by lightning or fire • Heavy snow loading • Bark soundness or slippage • Direction of lean • Degree of lean – slight or heavy • Head lean or side lean • Nesting and/or feeding holes • Rusty (discolored) knots • Punky (swollen or sunken) knots • Frozen wood • Footing Observe the base of the tree for: • "Thud" sounding • Conks and mushrooms	

OUTLINE	AIDS & CUES
• Rot and cankers • Shelf fungi or "bracket" • Wounds and scars • Split trunk • Insect activity • Feeding holes • Bark soundness • Resin flow on bark • Unstable root system and root protrusions	
EXERCISE: Complexity Versus Size Purpose: To introduce the concept of faller certification levels and the concept that complexity trumps any size class. Time: 15 minutes Format: Students will work in their small groups. Instructions: • In small groups, have the students discuss any limitations they feel are appropriate for fallers at a lower level certification (complexity versus size). • This discussion will give the instructor an opportunity to discuss the difficulty of this issue. Some situations with small-diameter trees (less than 24 inches diameter at breast height [d.b.h.])	Slide 1-54

OUTLINE	AIDS & CUES
are far more complex than situations with larger, healthy, straight trees (more than 24 inches d.b.h.).	
• Input and discussion from students should lead to an improved understanding of their responsibility to develop sound judgment of their ability to complete sawyer tasks and promote situational awareness.	
End of Exercise.	
C. Go/No-Go Decision	
Each limbing, bucking, and felling assignment along with its environment presents a complex set of factors that must be thoroughly evaluated to ensure effective and safe felling practices are used.	
The Go/No-Go Checklist is intended to be a tool for helping sawyers evaluate if a cutting situation is within their skill set and/or certification.	Slide 1-55 through Slide 1-59
A size of tree or a certification based on size can be used as a baseline; within an approved size range, further evaluation will be done with the checklist.	
This list is not a stand-alone sizeup list that covers a thorough hazard assessment of a cutting situation; it is only supplemental to a number of evaluation tools available. This is one example of a Go/No-Go checklist.	

OUTLINE	AIDS & CUES
Work through the list in order. For any questions that receive a NO answer, seek counsel with a more experienced faller, or refuse the felling operation.	
Review the example of a Go/No-Go Checklist with students.	IR 1-5 SR 1-5, Student Workbook, pages 1.43–1.45
1. **Hazards?** • Is there a safe location where you can work without unacceptable exposure to hazards? • This should be clear from overhead hazards, whether you are bucking or felling. • Good escape routes must be available. • There should be no threat from other trees that may be affected by your cutting, or to other people.	
2. **Clearance?** • During a felling operation, is there a clear and unobstructed lay for the tree, or can you safely create a space for it?	

OUTLINE	AIDS & CUES
• The intended lay needs to be appropriate for the lean of the tree. • When bucking or limbing, is there a clear path where the cut material can go? 3. **Hinge?** • During a felling operation, is the portion of the tree where the felling cuts must be made sound enough to allow you to create a sufficient hinge? • The quality of the hinge must allow for appropriate directional felling given the intended lay and the lean of the tree. 4. **Snags?** • Remember to include sizeup of snags in limbing and bucking operations, not just during felling operations. • If felling a snag, can it be done without the need for wedging—which could break the top out?	

OUTLINE	AIDS & CUES
• Remember, snags should not be directionally felled too far away from their natural lean because the holding wood can break easily. 5. **Top?** • If a tree has enough live material left to allow directional felling with a wedge, is the top sound enough to stay intact during wedging, and is the tree free of widow-makers? 6. **Platform?** • If wedges are needed, is there enough sound wood to provide a platform for the wedges to have the desired effect? • This is important for wedging during felling and bucking. 7. **Escape**? • Is the escape route adequate not only for felling, but when limbing or bucking? • Will the escape route remain clear through any possible complications during the felling and/or bucking?	

OUTLINE	AIDS & CUES
• Can you develop a clear felling plan that allows an escape route that provides a margin of error in the event of unforeseen hazards? • Are you confident you have the skill to safely and successfully complete the task? <u>Remember: Any situation that receives a **NO** answer should be discussed with a more experienced faller and possibly elevated to the next-level faller.</u> There are trees less than 10 inches d.b.h. that are too dangerous for an advanced faller. Other means of taking a tree down may have to be sought out if the tree truly needs to come down.	
D. Operational Leadership	Slide 1-60
1. Take Charge – You, as the faller, need to establish control of everyone who could be affected by your chain saw operation.	Slide 1-61

OUTLINE	AIDS & CUES
Lead student through the following discussion about leadership and refusing risk.	
What would you do if your supervisor came into your cutting area and demanded that you take a tree down that you are not comfortable with? Possible answers include: • Discuss with your supervisor the factors that led to your decision. • Attempt to develop mitigation methods. • If these attempts fail, elevate to the next level. Review the How To Properly Refuse Risk section in the IRPG.	Slide 1-62
2. Motivate – Motivate yourself and others to actively embrace safety, incorporate good cutting practices, and lead by example.	Slide 1-63
You are given an opportunity to fell some large trees that a fireline supervisor believes need to come down. Your expertise and local knowledge tell you that the trees don't truly need to come down. What would you do?	Slide 1-64

OUTLINE		AIDS & CUES
	Possible answers include: • Although sport felling can be fun, set the example for fellow crewmembers and other fallers by not felling the trees. • Take advantage of the opportunity to teach others that not all trees need to come down, even when damaged.	
3.	Demonstrate Initiative – Regardless of whether or not anyone is watching, ensure that you are cutting within your qualification level.	Slide 1-65
	You are given an assignment to fell a number of trees that are supposed to be within your certification level. Your fellow crewmembers are not in your immediate working area. You discover that some of these trees have defects that push them beyond your qualifications. You feel comfortable that your skill set would allow you to safely take them down. What should you do? Possible answer includes: • Do not cut the trees; lead by example and make arrangements to have a qualified faller onsite to take the trees down.	Slide 1-66

OUTLINE		AIDS & CUES
4.	Communicate – Ensure there is effective two-way communication. Take the time to communicate intent and solicit feedback from swampers, other fallers, supervisors, and adjoining resources.	Slide 1-67
	You notice your supervisor bucking trees out of the road and see that he didn't take time to put chaps on. What do you do? Possible answers include: • Signal the supervisor to stop cutting; offer chaps. • Speak to the supervisor in private.	Slide 1-68
5.	Supervise – Ensure safety, and provide purpose, direction, and motivation.	Slide 1-69
	Your crew is nearing the end of a long shift, and you only have 100 feet of line left to brush out. In an effort to finish the job sooner, your swamper starts to reach in while you are still actively cutting brush. What would you do? • Stop cutting. • Explain the importance of safety first, regardless of time restraints.	Slide 1-70

OUTLINE	AIDS & CUES
• If the swamper is doing it because of fatigue, make him or her take a break. Ensure they feel comfortable communicating if they need a break.	
Review unit objectives. **Present unit quiz.**	Slide 1-71 Slide 1-72

JOB HAZARD ANALYSIS (JHA)		Date: **05-31-20XX**	**X** New JHA Revised JHA
Organization/Park Unit: **National Interagency Template**	Division: **Wildland Fire**	Branch: **N/A**	Location: **United States**
JOB TITLE: **Working in the Vicinity of Hazard Trees**		JHA Number: **2005-01**	Page **1** of **6**
Job Performed By: **Wildland Fire Personnel**	Analysis By: **Interagency Task Group**	Supervisor: **Al King**	Concurred By: **Federal Fire and Aviation Safety Team (FFAST)**

Required Standards:	**Interagency Standards for Fire and Fire Aviation Operations; Wildland Fire Incident Management Field Guide; Incident Response Pocket Guide; Class A,B,C Faller Task Book. [Applicable agency specific standards must also be referenced. Examples include the Wildland Fire and Aviation Program Management and Operations Guide for the Bureau of Indian Affairs, the Health and Safety Code Handbook for the USDA-Forest Service and the Chainsaw Operator Training and Certification Policy for the Bureau of Land Management, Oregon State Office.]**
General Notes:	**The intent of this JHA is to serve as a template for field units to prepare local hazard tree JHAs that would be included with activity based JHAs for chain saw/cross cut saw operations, fire suppression, prescribed fire operations and other wildland fire related work activities. JHAs are most effective when they are project specific and are prepared at the local level by personnel who will be implementing the project. As a result, this example JHA should be modified as necessary to meet the specific work conditions and requirements of the local unit. This JHA only identifies the hazards and safe actions associated with working in the vicinity of potential hazard trees and specific hazard trees that have been identified. It does not analyze the other hazards associated with the work activity.**
Required Personal Protective Equipment:	**Wear agency approved hard hats whenever working in forested environments. Utilize all wildland fire PPE when performing wildland and prescribed operations, or as otherwise required. These include boots, fire shelter, hard hat, goggles/safety glasses, yellow aramid shirts, aramid trousers and leather gloves. Personnel who are exposed to noise levels in excess of 85 decibels, such as chain saw operators, are required to utilize ear plugs/hearing protection. In addition, all chain saw operators must wear chain saw chaps. Additional PPE may be required by local conditions, material safety data sheets and/or JHAs. See the Interagency Standards for Fire and Fire Aviation Operations for additional information.**
Tools and Equipment:	**Wildland fire hand tools (shovel, pulaski, etc.), chain saws/cross cut saws, saw service/repair kits, fuel and bar oil containers, axes and wedges, flagging, handheld radios, spare batteries for radios, first aid kits. For the sake of brevity, throughout the remainder of this JHA the term "chain saw" is used to refer to "chain saws and/or cross cut saws" unless otherwise specified.**

Activity/Sequence of Job Steps	Potential Hazards/ Injury sources	Safe Action or Procedure
Pre-work/Preseason Activities	**None**	**Where applicable and available, contact local agency foresters, unit resource management specialists, USDA-Forest Service, Forest Health Protection Offices, etc. to: 1. Identify high risk tree species in your particular area. These are generally trees that are more susceptible to heart rot, root rot or have shallow roots. 2. Where information is available, identify geographic areas where high concentrations of potential hazard trees are likely to exist. 3. Where information is available, obtain updates on current forest health trends and problems areas in your vicinity.**
Refresher Training	**None**	**1. During annual wildland fire and chain saw operator refresher training, provide updates, as available on current forest health trends and problem areas in the local area.**

JHA - CONTINUATION SHEET	JHA Number: **20XX-01**	Page **2** of **6**
Activity/Sequence of Job Steps	Potential Hazards/ Injury sources	Safe Action or Procedure
		2. Brief employees on recognition of hazard tree indicators, use of assessment techniques and appropriate risk mitigation measures. An excellent reference for hazard tree information is found at: http://www.fs.fed.us/r1/projects/haztree_index.shtml. Check for websites that contain regional specific information such as http://www.fs.fed.us/r5/spf/publications/fhp-pp-presentations.shtml for California.
Pre-work Briefing/Tailgate Safety Session	**None**	**1. Brief employees on work assignment and objectives.** **2. Insure required PPE is being utilized.** **3. Review applicable JHAs, Material Safety Data Sheets (MSDS), hazard tree indicators and mitigation measures including LCES (lookouts, communications, escape routes and safety zones). Refer to attachment at end of this JHA.** **4. Provide information on environmental conditions and forecasts (such as strong and/or gusty winds) that could affect hazard tree risks.** **5. Identify trigger points/decision points as warranted for conditions such as strong winds.** **6. Brief employees on the plan that would be executed in the event of a serious employee illness/injury that would require medical evacuation.**
Size-up of Worksite Conditions	**Struck by falling tree, tree limbs or other debris from tree.**	**1. Maintain situational awareness and utilize the risk management process. Refer to the Incident Response Pocket Guide or the Wildland Fire Incident Management Field Guide for a description of the risk management process.** **2. Look up, down and all around for hazard tree indicators and high risk tree species. Refer to attachment at the end of this JHA.** **3. Pay particular attention to burning trees and trees with dead or broken tops, dead or broken limbs, hung-up trees, trees with severe leans and other signs of significant weakness.** **4. Stay alert for environmental conditions that could increase hazard tree risks. These include strong/gusty winds, steep slopes and obscured visibility (such as smoke or limited daylight) that inhibits visibility of tree tops.** **5. Tree felling at night should be avoided whenever possible and should only occur when there is adequate lighting and the entire tree including the tree top and surrounding area can be seen by the faller. [Follow agency policy if the agency has established more stringent requirements. Forest Service employees should refer to the Health & Safety Code Handbook.]** **6. Communicate hazards to crew members, implement LCES and other hazard control measures.**

JHA - CONTINUATION SHEET	JHA Number: **20XX-01**	Page **3** of **6**
Activity/Sequence of Job Steps	Potential Hazards/ Injury sources	Safe Action or Procedure
Locating Fireline	**Struck by falling tree, tree limbs or other debris from tree.**	**1. Utilize the most qualified personnel on scene to scout and flag fireline.** **2. Locate fireline in areas with the least amount of potential hazard trees, as long as other fireline safety risks are not increased to an unacceptable level.** **3. Perform an initial size-up of potential hazard trees from a safe distance as determined by an assessment of on site conditions such as steepness of slope, number and density of trees in vicinity and potential for "domino effect", stability of trees, wind conditions and other applicable variables. [Follow agency policy if the agency has established more stringent requirements. Forest Service employees should refer to the Health & Safety Code Handbook.] Approach trees as warranted to conduct additional assessment.** **4. Insure LCES is in place when conducting the assessment in close proximity to potential hazard trees. Assess potential hazard trees to determine if a live tree or snag should be identified as a hazardous tree. Refer to assessment techniques in the attachment at end of this JHA.** **5. Flag or otherwise mark all identified hazard trees.**
Fireline Construction	**Struck by falling tree, tree limbs or other debris from tree.**	**1. Mitigating the risks of identified hazard trees will precede line construction. Mitigation may be accomplished by avoiding, felling or eliminating through other means (blasting, burning, heavy equipment, etc.).** **2. All personnel other than the faller, and the swamper if necessary, will keep a safe distance away from identified hazard trees. [Follow agency policy if agency has established more stringent requirements. Forest Service employees should refer to the Health & Code Handbook.]** **3. The safe distance will be determined by an assessment of on site conditions. As an example, the safe distance in flat terrain for one isolated snag in a brush field with no potential for a "domino effect" may be 1 tree length. In contrast, the safe distance on the down slope side of a large dense snag patch on very steep slopes may be in excess of 5 tree lengths. [Follow agency policy if the agency has established more stringent requirements. Forest Service employees should refer to the Health & Safety Code Handbook.]** **4. If the identified hazard tree cannot be safely removed, the area will be flagged off and fire personnel in the area will be notified to avoid the area.**

JHA - CONTINUATION SHEET	JHA Number: **20XX-01**	Page **4** of **6**
Activity/Sequence of Job Steps	Potential Hazards/ Injury sources	Safe Action or Procedure
		5. If dozers or other heavy equipment are assigned to fireline construction, personnel will stay a safe distance away as determined by an assessment on onsite conditions. **6. Continue to maintain situational awareness and utilize LCES and the risk management process.**
Falling Hazard Trees	**Struck by falling tree, tree limbs or other debris from tree.**	**1. Fallers have the responsibility to say "NO" and walk away from any situation they determine to be an unacceptable risk.** **2. Avoid felling trees during high or gusty winds, when lightning activity is occurring or if visibility of tree tops and surrounding area is obscured by darkness, smoke, fog or other conditions.** **3. Limit personnel at the base of the tree to the feller, certified for the appropriate size class, and the swamper when necessary. [Follow agency policy if the agency has established more stringent requirements. Forest Service employees should refer to the Health & Safety Code Handbook.]** **4. Implement LCES. Identify swamper, and as necessary, other personnel as lookouts. Confirm clear communications. Pre-identify multiple escape routes and safety zones.** **5. Size up the tree considering the tree species, height, diameter, lean, soundness, previous fire damage, fire currently in tree, split or broken top, "widow makers" and other hazard tree indicators. Bore tree if necessary to determine soundness.** **6. Clear escape routes and work area. Walk out and clear the intended lay.** **7. Fell tree using established felling procedures. Refer to faller Task Books, other applicable JHAs and any agency specific requirements.** **8. As tree begins to fall, watch top and move quickly away. If tree movement compromises the primary safety zone, use an alternate.** **9. Watch for falling tree tops and limbs for at least 30 seconds after tree hits the ground.**
Mop-up	**Struck by falling tree, tree limbs or other debris from tree.**	**1. Perform an initial size-up of potential hazard trees from a safe distance as determined by an assessment of on site conditions such as steepness of slope, number and density of trees in vicinity and potential for "domino effect", stability of trees, wind conditions and other applicable variables. [Follow agency policy if more stringent requirements have been established.] Approach trees as warranted to conduct additional assessment.**

JHA - CONTINUATION SHEET	JHA Number: **20XX-01**	Page **5** of **6**
Activity/Sequence of Job Steps	Potential Hazards/ Injury sources	Safe Action or Procedure
		2. Insure LCES is in place when conducting the assessment in close proximity to potential hazard trees. Assess potential hazard trees to determine if a live tree or snag should be identified as a hazardous tree. Refer to assessment techniques in the attachment at end of this JHA. **3. Flag or otherwise mark all identified hazard trees.** **4. Conduct risk assessment of the need to mop-up to meet fire control objectives versus the hazards associated with felling the hazard trees and conducting mop-up operations.** **5. Mitigating the risks of identified hazard trees will precede mop-up work. Mitigation may be accomplished by avoiding, felling or eliminating through other means (blasting, burning, heavy equipment, etc.).** **6. All personnel other than the faller (certified at the appropriate class) and, if necessary, the swamper will keep a safe distance away from identified hazard trees. [Follow agency policy if more stringent requirements have been established.]** **7. If the identified hazard tree cannot be safely removed, the area will be flagged off and fire personnel in the area will be notified to avoid the area.** **8. Continue to maintain situational awareness and utilize LCES.**
ICP, Camps, and Other Comparable Temporary Facilities	**Struck by falling tree, tree limbs or other debris from tree.**	**1. Potential hazard trees in and around ICPs, camps and sleeping areas must be assessed. Refer to hazard tree indicators and assessment process identified in other sections of this JHA.** **2. Identified hazard trees will be mitigated prior to use of the area for camps and other temporary fire facilities.** **3. If identified hazard trees cannot be safely felled or otherwise eliminated, the temporary facility will be reconfigured in such a manner that all personnel will be located a safe distance away from identified hazard trees. [Follow agency policy if more stringent requirements have been established.] Flag off or otherwise prevent entry to locations where the identified hazard trees may fall and notify all personnel of the "hazard – no entry areas".**

Potential Hazard Tree Indicators

NOTE: Trees with the indicators below are not all highly hazardous but should be carefully examined to assess the danger.

Indicators – Entire Tree
- Snags – standing dead tree or part of dead tree
- Moderate to severe lean (especially recent)

Crown Indicators
- Loss of needles & leaves
- Discoloration/dieback
- Thinning crown
- Stressed cone crop

Limb Indicators
- Dead/cracked/broken branches
- Fallen limbs on ground
- Rot or conks
- Cavities and cankers
- Mistletoe branches

Bole, Stem, Butt Indicators
- Dead/broken tops
- Forked/multiple tops
- Bole swelling
- Cracks or splits
- Cavities and cankers
- Rot or conks
- Wounds/damage – mechanical or fire
- Loose bark

Root & Tree Base Indicators
- Sprung roots – mounded soil or exposed roots
- Compaction & erosion
- Damage from previous fire(s)
- Wind-throw
- Basil resin flow
- Rot or conks
- Cracks or splits

Other Indicators
- Smoke or fire is visible in tree
- Area experiencing insect and/or disease infestations

Assessment Techniques – Potential Hazard Trees

NOTE: Potential hazard trees should be carefully inspected from top to bottom, including soil next to base of the tree. The assessment must include all sides (360°) of tree. Binoculars can aid in evaluating indicators higher in the tree. Much of hazard tree assessment is subjective and dependent on the skill level and experience of the inspector.

- Look for indicators of hazard and assess the degree of severity. Consider severity versus probability.
- Try to determine if decay or rot is associated with the hazard indicators, which makes failure more likely.
- Thump, bore, and dig as needed to assess conditions not immediately visible.
- Striking bole with a solid object (such as flat end of axe) will aid in hearing the hollow sound of a tree with advanced decay. Boring a tree will also reveal how sound the wood is.
- Digging around the roots may reveal if they are green & sound or are they dead, rotten, burned off or otherwise damaged.
- Evaluate wind (especially wind speed and variability in wind direction)
- What other safety hazards exist (uncontrolled fire, steep slopes, obscured visibility, aviation operations, power lines, etc.)?

Risk Mitigation Measures – Identified Hazard Trees

- Utilize LCES (Lookouts, Communications, Escape Routes & Safety Zones) whenever working in the vicinity of hazard trees.
- Eliminate identified hazard trees (consider all techniques such as saw, burn, blast, cable, heavy equipment).
- Use traffic control when felling trees in the vicinity of roads, trails, firelines, etc.
- Ensure that felling operations do not endanger nearby workers. Avoid working down slope of felling activities.
- If unable to eliminate an identified hazard tree, it should be flagged and avoided.
- Identified hazard trees that can't be eliminated must be communicated to all other employees working in the area.
- Reassess situation as conditions change.

JHA Analysis Interagency Task Group
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Form 1112-5
(May 2001)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

RISK MANAGEMENT WORKSHEET

1. Organization and Location			2. Page ___1_____of_____14_____
3. Operation / Task	4. Beginning Date:	5. Ending Date:	6. Date Prepared

7. Prepared by *(Name / Duty Position)*

8. Identified Hazards	9. Assess the Hazards: Initial Risk				10. Control Measures Developed for Identified Hazards*: (Specific measures taken to reduce the probability of a hazard)*	11. Assess the Hazard's Residual Risk:				12. How to Implement the Controls: *(Include SOP's, references, etc.)*	13. Supervisors and Evaluation by: (Continuous Leader Checks, Buddy System, etc.)
(Be Specific)	L	M	H	E	(Be Specific)	L	M	H	E	(Be Specific)	(Be Specific)
1) GENERAL CHAINSAW OPERATIONS:											

14. Remaining Risk Level After Control Measures Are Implemented: (CIRCLE HIGHEST REMAINING RISK LEVEL)	**LOW** (Line Supervisor)	**MEDIUM** (Branch Chief)	**HIGH** (District Manager	**EXTREMELY HIGH** (Must be State Director/Associate)

15. RISK DECISION AUTHORITY: **(Approval/Authority Signature Block)** (If Initial Risk Level is Medium, High or Extremely High, Brief Risk Decision Authority at that level on Controls and Control Measures used to reduce risks) (**Note**: if the person preparing the form signs this block, the signature indicates only that the appropriate risk decision authority was notified of the initial risk level, control measures taken and appropriate resources requested; and that the risk was accepted by the decision authority.)

_____
(Signature)

CARE AND CLEANING OF CHAIN SAW CHAPS

Caring for Chaps

- ✓ Treat your chain saw chaps as a CRITICAL piece of safety equipment.
- ✓ Keep them as clean as possible.
- ✓ Appropriate and timely cleaning reduces the flammability of the chaps and keeps your clothing cleaner.
- ✓ **Do not use your chaps as a chain stop.**

Cleaning Chaps

- ✓ Hose and brush off chain saw chaps to remove dirt.
- ✓ **Do not** machine wash or machine dry chain saw chaps.
- ✓ Use an approved product such as Citrosqueeze, a commercially available citrus-based cleaning product, to clean chain saw chaps. Citrosqueeze has been tested and approved by Dupont for cleaning Nomex and Kevlar.
    - Citrosqueeze must be diluted before use.
    - For light soiling, use a Citrosqueeze solution in a spray bottle, mixing 1 part Citrosqueeze concentrate to 10 parts water. Spray solution on the area to be cleaned and brush the solution into the chaps with a bristle brush. Wait ½ hour, thoroughly rinse the chaps with cold water, and allow them to air dry.
    - For heavy petroleum contamination, soak chain saw chaps in Citrosqueeze solution for a minimum of 4 hours, overnight if possible. Brush the chaps with a bristle brush, rinse them thoroughly with cold water, and allow them to air dry.
    - Many pairs of chain saw chaps can be cleaned in a single soak tank. Use 10 to 15 gallons of solution in a soak tank.

A United States manufacturer for Citrosqueeze is:

Emco Industries, Inc.
3800 Oceanic Drive, Suite 109
Oceanside, CA 92056
Phone: (888) 727-3230

Repairing Chaps

Clean all chaps before repairing them. Repair cuts and holes in the outer shell as soon as possible to prevent the protective Kevlar pad from becoming contaminated with bar oil and petroleum products.

When repairing damage to the chaps' nylon shell, use a commercially available product called Seam Grip. Seam Grip provides a flexible, waterproof, and abrasion-resistant patch that will prevent petroleum products from contaminating the protective Kevlar pad.

Remove chain saw chaps from service if they have a cut longer than 1 inch in the top layer of Kevlar.

To repair holes and tears in the nylon shell:

1. Cut a piece of notebook or printer paper that extends about 2 inches beyond the edge of the damage.

2. Slip the paper inside the hole or tear so the paper lies on top of the protective Kevlar pad.

3. Lay the chaps on a flat, level surface, and press the nylon shell down onto the piece of paper.

4. Squeeze Seam Grip onto the paper and onto the sides of the tear so that there is good coverage on all sides of the tear or hole.

5. Allow the patch to dry for at least 12 hours before using the chaps. Seam Grip is available through outdoor retailers.

   To locate Seam Grip retailers in your area, contact:

   McNett Corporation
   1411 Meador Avenue
   Bellingham, WA 98229
   Phone: (360) 671-2227
   Fax: (360) 671-4521
   Website: http://www.mcnett.com

SITUATIONAL AWARENESS AND INDIVIDUAL COMPLEXITY LIST

THE COMPLEXITY OF THE ASSIGNMENT MUST BE DETERMINED BY THE INDIVIDUAL SAWYER. This is based on his or her individual skill, knowledge, and understanding of personal capabilities and limitations. Therefore, the final decision to cut any tree is left up to the individual sawyer, giving her or him the choice to say "NO" and walk away from any sawing situation they have determined to be beyond their capabilities.

If a thorough job of assessing the complexity of the individual situation has been completed, the decision to cut or not to cut will be determined by the Go/No-Go process. You must be able to say the following, "I feel comfortable with the sawing situation; I will cut it," or "I don't feel comfortable with the situation; I will walk away from it." **Do not base your decision on the idea that, "I <u>think</u> I can do it."**

SAFETY CONSIDERATIONS AND ATTITUDE

- How do you feel about this sawing assignment?
- Are you exercising sound judgment and awareness?
- Is your attitude convincing you to go against your better judgment (gut feeling)?
- Is your mind on your work?
- Do you have self-confidence?
- Are you overconfident?
- Are you doing this against your will?
- Is peer pressure a factor?
- Are you professional enough to decline the assignment and ask for assistance?
- Do you have all the required PPE and sawing equipment to do the job?
- Are you complacent—unconcerned about potential danger?
- Are you violating any safe operating procedures?
- Do you feel hurried or unusually stressed to get the tree on the ground or bucked?
- Have all options been considered and discussed with others?
- Are you in an unfamiliar environment and timber type?
- Do you watch out for your coworkers and the public?

PHYSICAL CONSIDERATIONS

- General health
- Physical conditioning
- On medication or using any recreational substance
- Fatigue (can affect good judgment)
- Time of day
- Work-rest cycles (adequate rest)
- Dehydration

ENVIRONMENTAL CONSIDERATIONS

- Light conditions
- Rain, fog, or snow
- Smoke or dust
- Wind direction and speed
- Insect damage
- Heat or cold
- Tree spacing

FELLING

Analyze the felling job by considering:

- Tree species; live or dead
- Size and length
- Soundness and defects
- Twin tops or school-marm
- Widow-makers and hangups
- Heavy branches / weight distribution
- Burning top
- Spike top
- Splits and frost cracks
- Deformities such as those caused by mistletoe
- Damage by lightning or fire
- Heavy snow loading
- Bark soundness or slippage
- Direction of lean
- Degree of lean, slight or heavy
- Head lean or side lean
- Nesting or feeding holes, or both
- Rusty (discolored) knots
- Punky (swollen and sunken) knots
- Frozen wood
- Footing

(Continued on next page.)

FELLING (Cont.)

Observe the base of the tree for:

- "Thud" sounding
- Conks and mushrooms
- Rot and cankers
- Shelf fungi or "bracket"
- Wounds and scars
- Split trunk
- Insect activity
- Feeding holes
- Bark soundness
- Resin flow on bark
- Unstable root system and root protrusions

Examine surrounding terrain for:

- Steepness of ground
- Irregularities in the ground
- Draws and ridges
- Rocks
- Stumps
- Loose logs
- Ground debris that can "fly" back or kick up at the sawyer

Examine immediate work area for:

- Overhead hazards
- People, roads, and/or vehicles
- Power lines
- Driver trees
- Hangups
- Consider potential reaction of other trees
- Other trees that may have to be felled first
- Nearby hazards such as trees, rocks, brush, or low-hanging limbs
- Structures
- Openings to fell trees to
- Snags
- Fire-weakened trees
- Widow-makers

ESCAPE ROUTES AND SAFE ZONES

Walk out and thoroughly check the intended lay or bed of the tree. Look for dead treetops, snags, and widow-makers that may cause kickbacks or result in another tree or limb becoming a hazard. The primary escape route and alternates must be a predetermined path along which the sawyer proceeds once the tree is committed to the fall or to the bucking cut. Safe zones should be no less than 20 feet from the stump; preferably, stand behind another tree (sound and of sufficient size to give protection) and watch for whiplash, broken tree parts, etc. Escape routes and safe zones should be 90 to 135 degrees from the direction of fall. Sawyers must select and prepare the work area, and clear escape routes and alternates before starting the first cut.

BUCKING

- Never buck a tree that is considered unusually dangerous.
- Consider overhead hazards.
- Is guide bar length adequate for the tree to be bucked?
- Establish good footing, and swamp out bucking areas and escape route.
- Select bucking cut carefully.
- Anticipate log's reaction when severed.

***Examine the log and immediate area for**:*

- Percent of slope or incline
- Potential for log to roll, slide, or bind
- Tension
- Compression
- Rocks and foreign objects on the log
- People and property in the cutting zone
- Spring poles
- Fire
- Root wads
- Overhead hazards
- Rocks or other items the tree may dislodge

GO/NO-GO CHECKLIST FOR CHAIN SAW OPERATIONS

Instructions

Each limbing, bucking, and felling assignment, along with its environment, presents a complex set of factors that must be thoroughly evaluated to ensure effective and safe cutting practices are used.

The checklist on the following page is intended to be a tool for helping sawyers evaluate if a cutting situation is within their skill set and/or certification. This list is not a sizeup list that leads a sawyer through hazards associated with a tree—it is only supplemental to a number of evaluation tools available and is just one example of a Go/No-Go checklist. Any situation that receives a NO answer should be discussed with a more experienced faller and possibly elevated to the next-level faller.

GO/NO-GO CHECKLIST FOR CHAIN SAW OPERATIONS

Yes	No	Go/No-Go Questions
Hazards		
		Is there a safe location where you can work without unacceptable exposure to hazards?
		Is the location clear from overhead hazards, whether you are felling or bucking?
		Is the location clear of any threat from other trees that may be affected by your cutting?
		Does location avoid risk to other people?
Clearance		
		When felling, is there a clear and unobstructed lay for the tree, or can you safely create a space for it?
		Is the intended lay appropriate for the lean of the tree?
		When bucking or limbing, is there a clear path where the cut material can go?
Hinge		
		Is the portion of the tree where the felling cuts must be made sound enough to create a sufficient hinge? (The quality of the hinge must allow for appropriate directional felling given the intended lay and the lean of the tree.)
Snags		
		Remember to include sizeup of snags in limbing and bucking operations, not just during felling operations.
		If felling a snag, can it be done without wedging—which could break the top out?
		Can the snag be directionally felled close to its natural lean? (The holding wood can break easily.)
Top		
		If a tree has enough live material left to allow directional felling with a wedge, is the top sound enough to stay intact during wedging?
		Is the tree free of widow-makers?
Platform		
		If wedges are needed, is there enough sound wood to provide a platform for the wedges to have the desired effect? (This is important during felling *and* bucking.)
Escape Route		
		Is the escape route adequate for felling?
		Is the escape route adequate when limbing or bucking?
		Will the escape route remain clear through any possible complications during felling or bucking?
		Can you develop a clear felling plan that allows an escape route that provides a margin of error?
		Are you confident you have the skill to safely and successfully complete the task?

Remember: Any of the above questions that receive a **NO** answer should be discussed with a more experienced faller and possibly elevated to the next-level faller. There are trees less than 10 inches in diameter at breast height that are too dangerous for an advanced faller. Other means of taking a tree down may have to be sought out if the tree truly needs to come down.

UNIT OVERVIEW

Course Wildland Fire Chain Saws, S-212

Unit 2 – Chain Saw Parts, Maintenance, and Operation

Time 4 hours (2 hours classroom and 2+ hours for exercise)

Objectives

1. Identify basic chain saw parts, adjustments, troubleshooting, maintenance, and chain saw safety features.
2. Demonstrate maintenance tasks required for chain saw operation.
3. Demonstrate chain saw transporting and starting procedures.
4. Demonstrate the use of tools and supplies that support chain saw operations.

Strategy

For this unit, have on hand examples of chain saws, bars, chains, and chain saw maintenance tools. It is important to show students examples of the three types of chains, chains that have been damaged, and chains that have been improperly sharpened. Provide examples of solid nose and sprocket nose guide bars and worn and damaged guide bars.

For the exercise, students in groups will be given hands-on practice learning basic field maintenance of the chain saw, including cleaning, chain sharpening, and basic troubleshooting of the power head and cutting attachments. Provide no less than one chain saw per student group, preferably the make and size of saw they will be using in the field. In groups of 3 to 5 students, guide them through chain saw part identification, and troubleshooting of the power head, bar, and chain.

Allow enough time for each student to sharpen a section of chain, disassemble portions of the saw for cleaning and identification of parts, and tension the bar and chain, and, if the location allows for it, practice chain saw starting procedures.

All groups should be taught the same material. To standardize instruction within the groups, use this outline as a guide. Instructors may create a checklist for each instructor to follow with their group, or set up stations for the student groups to rotate through and have each instructor cover a specific topic.

Students should be provided with a copy of the owner's manual and safety manual for the brand of chain saw they will be using. See Appendix A for sources of supply.

The major chain saw manufacturers and parts suppliers provide training seminars in chain saw safety and maintenance (Oregon Cutting Systems, Stihl, Husqvarna). Local commercial chain saw shops often provide a similar service. You may choose to add to this unit by taking advantage of one of these services, but you will need to increase the course hours to accommodate it.

Instructional Method(s)

- Lecture and discussion with PowerPoint presentation
- Exercise

Instructional Aids

- ☐ Computer with LCD projector, presentation software, and screen.
- ☐ Stihl (or Husqvarna) Owner's Manual and/or the Oregon Maintenance and Safety Manual.
- ☐ See Chain Saw Maintenance Exercise for list of equipment and materials needed.

Exercise(s)

- Chain Saw Maintenance

Evaluation Method(s)

- Students will be evaluated by instructors on their participation and performance during the exercise.

  Unit quiz.

Outline

I. Chain Saw Parts and Adjustments

II. Chain Saw Maintenance

III. Chain Saw Transportation

IV. Safe Starting of Chain Saws

V. Additional Tools and Supplies

Aids and Cues Codes

The codes in the Aids and Cues column are defined as follows:

IG – Instructor Guide
SW – Student Workbook
HO – Handout
IR – Instructor Reference
SR – Student Reference
Slide – PowerPoint

UNIT PRESENTATION

Course Wildland Fire Chain Saws, S-212

Unit 2 – Chain Saw Parts, Maintenance, and Operation

OUTLINE	AIDS & CUES
Present unit title slide.	Slide 2-1
Present unit objectives and exercise objectives.	Slide 2-2 Slide 2-3
I. CHAIN SAW PARTS AND ADJUSTMENTS	
The bar and chain are the most important parts of your chain saw. A sharp chain produces shavings that fall to the ground away from the power head. A clean bar in good condition guides the chain through the cut, making a straight, true cut. A dull chain produces sawdust that gets sucked into the air filter, cutting down the airflow to the power head and reducing power. A dull chain does not allow the saw to cut smoothly and puts unnecessary strain on the power head. The sawyer is forced to press the chain saw into the cut, increasing the stress on the power head. An improperly maintained bar and chain will damage the power head. As the sawyer works harder to make the saw cut, the sawyer may become fatigued, increasing the risk of accident or injury. A dull chain also increases the risk of kickback.	Slide 2-4

OUTLINE	AIDS & CUES
A. Chain Saw Parts	
Refer students to the Chain Saw Parts diagram.	IR 2-1 SR 2-1, Student Workbook, page 2.37
1. Saw chain Selecting the proper chain is important for operating a chain saw safely. The saw chain is made up of several parts that work together and must be properly maintained for maximum performance and safety.	
The cutter is the part of the saw chain that does the cutting. The saw chain has left-hand and right-hand cutters so that the saw chain will cut evenly through the wood.	Slide 2-5
The depth gauge (or raker) on the cutter determines the depth of the cut. The cutting corner on the top plate of the cutter severs the cross grains. This is the hardest part of the work. The top plate's cutting edge chisels and removes the severed wood fibers, creating the kerf.	Slide 2-6 Slide 2-7 Slide 2-8 Slide 2-9 (video)

OUTLINE	AIDS & CUES
a. Saw chain cutters The three most common types of saw chain cutters used are:	Slide 2-10
• Chipper: The most versatile cutter type. Chipper chain is the easiest to file and will tolerate dirt and dust. Chipper chain cuts smoothly and is well suited for most wildland fire chain saw operations.	Slide 2-11
• Chisel: The most aggressive cutter type. Chisel comes in both round and square ground types. The round ground chisel requires the proper size round file for proper sharpening. The square ground chisel requires a double bevel, hexagon, or single bevel file to sharpen it. The square ground chisel is designed to be used in production type felling for cutting clean wood. This is the fastest type of cutter in clean wood; however, it dulls the fastest in dirty or	Slide 2-12

OUTLINE	AIDS & CUES
fire-hardened wood and requires special training to sharpen. Neither the round or the square ground chisel cutter is recommended by the manufacturers for brushing or limbing; however, the round ground chisel is the most common cutter found on the fireline.	
• Semichisel: A less aggressive cutter type than a chisel cutter. A round file is used with a file guide when filing semichisel chain. The semichisel cutter is more tolerant of dirt and dust and stays sharp longer than the other cutters.	Slide 2-13
Low-kickback chain is available with chipper, chisel, and semichisel cutters. Low-kickback chain is the most desirable chain for training inexperienced sawyers. The chain cuts smoothly and is ideal for cutting brush, small-diameter material, dimensional lumber, house logs, and other materials	

OUTLINE	AIDS & CUES
that aren't normally cut with chain saws. Less aggressive cutting angles and features added to the depth gauge and drive links provide lower kickback response. b. Other chain parts • Tie strap: Holds the parts of the saw chain together. Over time, rivet holes on the tie strap will elongate and the chain will become loose and will need to be tightened. • Drive link: Fits in the bar groove so the bar can guide the chain, and into the chain sprocket so the power head can drive the chain around the bar. Draws oil from the bar groove to lubricate the bar and chain. • Master link: A special drive link that is used to join both ends of the chain when building a loop of chain from a roll. Typically yellow in color for easy	Slide 2-14

OUTLINE	AIDS & CUES
identification. There should be no more than two master links in any chain.	
c. Cutter sequences Cutter sequences on common types of saw chains are: • Standard (full comp): This chain has a cutter sequence of left-hand cutter, tie strap, right-hand cutter, tie strap, left-hand cutter, tie strap, right-hand cutter, for the length of the chain. Although this type of chain has low kickback, it is less aggressive and requires more time for sharpening. • Semiskip (most common for wildfire use): This chain has a cutter sequence of left-hand cutter, two tie straps, right-hand cutter, one tie strap, left-hand cutter, two tie straps, right-hand cutter, one tie strap, left-hand cutter, for the length of the chain.	Slide 2-15

OUTLINE	AIDS & CUES
• Skip or full skip: This chain has a cutter sequence of left-hand cutter, two tie straps, right-hand cutter, two tie straps, for the length of the chain. This aggressive chain removes dust and dirt from the cut well, but has higher kickback. When ordering replacement saw chain, you must identify: • Pitch – the measure between any two rivets divided by two (example, 3/8; found on the bar). • Gauge – the thickness of the drive link tang (may be marked on the side of the drive link). • Number of drivers – 84 for a 24-inch bar (found on the bar).	

OUTLINE	AIDS & CUES
It also helps to provide the make of the saw and the bar length. Most bars are marked with this information. Identify the type of cutter desired, and whether it should be full comp or skip.	Slide 2-16
2. Guide bars	Slide 2-17
The guide bar supports and guides the saw chain. The most common types of bars are solid nose (or "tip") and sprocket nose (or "roller tip").	Slide 2-18
• A solid nose bar is usually found on small saws. The bar is solid without a sprocket.	
• A sprocket nose bar has a sprocket (a toothed wheel) in the nose to reduce drag and help the chain move freely around the bar.	
• A reduced-weight bar has a lightweight insert to reduce the weight. Although lighter, reduced-weight bars tend to be more fragile.	Slide 2-19

OUTLINE	AIDS & CUES
Bow bars (a type of guide bar) are no longer approved for use on Stihl or Husqvarna chain saws (see owner's manuals; web addresses are listed in Appendix A). One of the primary reasons is that the bow bar changes the saw's center of gravity, preventing the chain brake from engaging properly during kickback. Bow bars should be removed from service.	
3. Other parts of the chain saw **Bar studs** – Hold the bar and the chain sprocket cover in place. **Chain tension adjustment screw** – Moves the guide bar to maintain proper tension on the saw chain. **Chain sprocket** – The toothed wheel that drives the saw chain. **Chain brake** – Stops the saw chain if it is activated by the sawyer's hand or by inertia (during kickback). **Clutch** – Couples the engine to the chain sprocket when the engine is accelerated above idle speed. **Chain catcher** – Helps reduce the risk of the saw chain contacting the sawyer if the chain breaks or if the chain is thrown off the bar. **Starter grip** – A rubber or plastic handle attached to the starter pull rope.	Slide 2-20 through Slide 2-23

OUTLINE	AIDS & CUES
Dogs (or bumper spikes) – Hold the saw steady against wood. **Front handlebar** – Is used to hold the front of the saw. **Gunning sights (or marks)** – Used to determine the planned direction of the tree's fall based on the face cut. **Rear handle** – Used to hold the rear of the saw. **Throttle trigger** – Controls the speed of the engine. **Oiler adjustment screw** – Adjusts the amount of oil dispensed to the bar and chain. **Throttle interlock** – Prevents the throttle from being activated unless it is depressed. **On/off switch** – Turns the saw on and off. **Choke** – Used for starting a cold saw. **Air filter cover** – Holds the air filter in place and covers the carburetor. **Air filter** – Prevents dirt, dust, and sawdust from entering the carburetor.	

OUTLINE	AIDS & CUES
Fuel filter – Prevents dirt and other contaminants from entering the saw's carburetor. **Oil and fuel caps** – Seal the oil and fuel tanks. **Muffler** – Reduces exhaust noise. **Spark arrester** – Prevents hot sparks from leaving the muffler. **Spark plug** – Ignites fuel in the power head. **Decompression valve** – Reduces pressure in cylinder head to allow for easier starting.	
For an in-depth parts list, obtain a copy of the owner's manual for specific saws (see Appendix A). Tell the students they should take the owner's manual with them when they travel to incidents to assist with ordering the correct replacement parts.	
B. Carburetor Adjustments	Slide 2-24
Refer to the Chain Saw Troubleshooting Checklist.	IR 2-2 SR 2-2, Student Workbook, pages 2.39–2.43
Chain saws have a two-stage carburetor that provides fuel to the engine in any position in which a saw may be held. ALWAYS clean the air filter (covered later in this unit) and then recheck saw operation before making any carburetor adjustment.	

OUTLINE	AIDS & CUES
The carburetor has three adjustments: • The idle-speed adjustment sets the speed at which the saw's engine will run by itself. • The low-speed adjustment controls the amount of fuel put into the carburetor when the throttle is not engaged. • The high-speed adjustment controls the amount of fuel put into the carburetor when the throttle is engaged. The low- and high-speed adjustments should be made by a qualified saw mechanic using a tachometer. Improper adjustment can result in poor lubrication and operation with potential severe damage to the chain saw. Always follow procedures outlined in the manufacturer's owner's manual. **Removal of the low- or high-speed plugs on newer model saws violates U.S. Environmental Protection Agency (EPA) regulations.** Because the idle setting is most often in need of adjustment, it may need to be adjusted in the field. Before adjusting the idle, be sure that the air filter and fuel filter are clean and that you are using the correct fuel mixture. Dirty filters or improper fuel mixtures affect the idle speed.	Slide 2-25

OUTLINE	AIDS & CUES
Newer saws designed to meet the U.S. Environmental Protection Agency (EPA) air quality standards may not have all three adjustments.	
C. Mounts or Antivibration System Mounts or antivibration systems function as buffers between the chain saw engine and the handles to reduce vibrations to the sawyer's hands.	
II. CHAIN SAW MAINTENANCE	
Show the students a variety of guide bars with different types of damage.	
A. Guide Bar Maintenance Most guide bar problems develop in the bar rails and are caused by: • Incorrect chain tension • Lack of lubrication • Improper cutting technique • Normal wear Look for several rail conditions when performing daily maintenance on your saw. These conditions can be corrected if they are caught early. If they are ignored, they will destroy the bar or lead to cutting problems.	Slide 2-26
Poor rail conditions may prevent cutting straight or matching cuts on larger material. In addition, the chain may be thrown off the	Slide 2-27 Slide 2-28

OUTLINE	AIDS & CUES
bar because the chain tension is harder to control. Poor rail conditions include: • Rails are worn down and the groove becomes shallow. If the groove is too shallow and the tie straps do not touch the rails, replace the bar. • The outside edges of the rails develop wire edges. Use a bar dressing or flat file to remove them. • The rail is worn low on one side. This causes the chain to cut at an angle. The bar will have to be ground on a specialized bar grinder. You may need to take the bar to a dealer or to a trained saw mechanic if your unit doesn't have a specialized bar grinder. • The rails show blue discoloration along the bar or at the tip of the sprocket nose. This discoloration is caused by excessive heat due to: – Lack of lubrication – Poor cutting methods that push the drive links to the side – A chain that is too tight – A dull or improperly filed chain • Worn spots that are soft will wear rapidly; you will need to replace the bar.	Slide 2-29

OUTLINE	AIDS & CUES
• Splayed or pinched groove or incorrect depth. • The bar shows excessive wear only behind the nose on solid nose bars or behind the sprocket on sprocket nose bars. Excessive wear can be caused by heavy use near the nose of the bar (such as occurs when limbing) or by a chain that is too loose. You can reduce this wear by periodically turning the bar over. If wear becomes extensive, you may need to replace the bar. • If the sprocket teeth on the bar are pointed, the nose should be replaced, if possible. This condition causes chain wear on the drive link connection points. • If the nose is not greased on a regular basis, do not grease it. The bar and chain oil can provide lubrication to the bearings. If the nose is greased only periodically, the grease will aid in holding debris in the bearings, shortening their service life. If the nose is being greased, it must be greased after every tank of gas.	

OUTLINE	AIDS & CUES
• The bar is bent. This can be caused by improper cutting techniques, getting the saw pinched or bound in the cut, and improper transportation (such as carrying a saw loose in the bed of a pickup). Minor bends in bars can be straightened by a shop with the proper equipment. There are hand-held files that can be used in the field to dress the rails of bars, rather than taking them to a shop to be dressed. If the bar is in very bad condition, a specialized shop grinder may be necessary to reshape the bar rails. The condition of the guide bar has as much to do with the performance of your chain saw as the condition of the chain. The bar and the chain work together. When both are in proper condition, the chain saw does the work. All you have to do is guide it.	
B. Chain Tension	
1. Remember four basic rules before adjusting the tension of the saw chain:	
• Turn the saw off! • Wear protective gloves. • Wait until the bar and chain have cooled before adjusting the tension. • Recheck chain tension at least every fuel cycle.	Slide 2-30

OUTLINE		AIDS & CUES
	Heat causes the bar and chain to expand when the chain saw is being used. If the tension is set while the chain is hot, the chain will be too tight when it cools. Tension that is set too tightly can damage the bar and the chain.	
2.	To adjust the chain tension on a solid nose guide bar:	Slide 2-31
	• Disengage the chain brake.	
	• Loosen the bar studs on the side of the saw.	
	• Pull the nose of the bar up, and keep the nose up as you adjust the tension.	
	• Turn the guide bar's chain tension adjustment screw until the bottoms of the lowest tie straps and cutters just touch the bottom of the bar.	
	• Still holding the nose up, tighten the rear bar stud, then the front bar stud.	Slide 2-32
	• Pull the chain by hand along the top of the bar several times from the engine to the tip. The chain should feel snug but pull freely.	

- "Snap test" the chain tension by pulling down on the chain and letting it snap back into the bar groove, ensuring roughly 1/8 inch of free play.
- If chain tension is too tight, make sure to loosen the bar studs before adjusting the chain tension adjustment screw.
- The tension can be tighter on a sprocket nose bar than on a solid nose bar.

Demonstrate proper and improper tension so students can feel the difference (may be saved for the exercise).

C. Daily Saw Maintenance

For this section, have two bars on hand, one that needs to be cleaned and one that is worn. Have one saw for every three students.

As the chain goes around the bar, it wears the bar and the chain. Because the bar is made of softer metal than the chain, the bar develops more wear than the chain. Generally, one rail will wear more than the other, causing the saw to cut at an angle if the bar and the chain are not properly maintained.

OUTLINE	AIDS & CUES
Chain saws have a chain oiler to provide lubrication to reduce friction between the bar and the saw chain, minimizing wear and prolonging the life of the bar and chain. The oiler provides oil through a small hole in the bar that lines up with the oiler on the power head. As oil is pumped through the oil hole, the chain carries it around the bar, lubricating the top, bottom, and nose. During operation, debris begins to build up in the chain groove. If the groove is not cleaned, oil cannot lubricate the entire bar, causing excessive wear and damage. If the oiler is properly adjusted, a full tank of gas will run dry before the oil tank is empty. As a general rule, a tank of oil should last as long as or longer than a tank of gas. Clean and rotate the bar each time you file the chain or at least once a day. Be sure to wipe the bar clean after filing the chain because filings act as an abrasive, increasing the wear on the bar.	Slide 2-33

OUTLINE	AIDS & CUES
Perform the following chain saw maintenance tasks daily:	
1. Remove the bar and chain for inspection and cleaning.	Slide 2-34
• Check the bar for wear. Look for uneven rails, flared edges, cracks, and other damage that would require the bar to be repaired or serviced.	
Clean the chain groove and oil holes. The proper method for cleaning the chain groove is to start at the nose with the bar tool, and clean toward the base, moving debris away from the nose. Be sure that the oil holes are clean.	
• The sprocket nose should spin freely.	
• Grease roller tip.	
2. Remove and clean the air filter.	Slide 2-35
• <u>Never use compressed air to blow out the air filter.</u> Using compressed air will drive contaminants into the filter and create holes in the filter material.	
• Manually close the choke to prevent debris from entering the carburetor.	

OUTLINE	AIDS & CUES
• Remove the air filter cover. Blow or shake off loose chips or particles surrounding the air filter. • Remove the filter from the carburetor. Take care not to damage the filter. Gently tap the filter against a hard surface. Don't rub or scrape it. Do not clean the filter with saw fuel. A damaged air filter can allow dust and debris into the engine, causing excessive wear and other problems. • Follow the manufacturer's recommendations (found in the instruction manual) for cleaning the air filter and determining whether it needs to be replaced. • If an air filter has a hole or any material is removed from the filtering agent, replace the filter immediately. • A soft paintbrush or toothbrush can be used to brush off an air filter. The best way to clean an air filter is with mild detergent and water and allow the filter to dry before using. A dirty or plugged air filter reduces	

OUTLINE	AIDS & CUES
engine power and performance and may cause other seemingly unrelated problems. • During wildfire operations, especially during mop up, you may need to clean the air filter more frequently to prevent performance problems or engine damage. • Never use a cleaning solvent or aerosol such as carburetor cleaner, engine starting fluid, etc., to clean an air filter, as these products can damage an air filter.	
3. Check the muffler and spark arrester. • Replace the spark arrester screen if it has any holes.	Slide 2-36
4. Inspect the power head for loose bolts and damage. • Tighten the bolts or repair the power head if necessary. • Check the handlebars for loose bolts or cracks. • Check the dogs for loose or bent bolts.	Slide 2-37

OUTLINE	AIDS & CUES
• Check the antivibration mounts. Look for cracks or damage in the engine mount system. Excessive movement of the engine or a loose feeling when the saw is held by the handles and shaken indicates that the mounts may be broken or need to be tightened.	
5. Replace the guide bar and chain.	Slide 2-38
• Rotate the bar so that it wears evenly.	
• Check for proper alignment of the bar with the bar studs, tension adjuster, and oiler.	
• Check the chain tension. The chain should be adjusted so that it doesn't hang from the bar but still turns freely.	
• Check the chain brake to ensure it is operating properly.	
6. Inspect safety features of the chain saw (black/gray check process).	Slide 2-39
• Black check (Stihl). By checking the condition and function of all black (gray for Husqvarna) fasteners, switches, and handles, you have completed a full safety feature check.	

OUTLINE	AIDS & CUES
• Inspect the chain catch for looseness or damage, and tighten or replace if necessary. • Inspect the chain brake, and clean around the brake area, removing any debris that may be built up around it. • Inspect the throttle lock system to ensure it is functioning properly. If it is not, repair or replace it.	
D. Weekly Chain Saw Maintenance • Check anti-vibration (shock absorption) systems for damage and wear. • Check and lubricate clutch drum bearing. • File off any burrs on sides of guide bar. • Check spark plug. Remove spark plug; check for fouling – the tip of the plug should be beige, not black. The plug should be dry.	Slide 2-40

OUTLINE	AIDS & CUES
Ensure the plug is gapped if the saw is not running correctly. Check manufacturer's gap specifications. • Check starter assembly, and rewind spring for proper tension. • Clean flywheel fins. • Clean cooling fins on cylinder. • Remove carbon buildup on muffler screen. • Change screen when mesh openings exceed 0.025 inches (0.0635 cm). • Clean carburetor body and under air filter cover.	Slide 2-41
E. Monthly Chain Saw Maintenance • Check chain brake for wear. • If tools and skill are available, check clutch center, clutch drum, and clutch springs for wear. • Check fuel filter. Change if necessary. • Flush inside of chain oil tank with straight gasoline.	Slide 2-42

OUTLINE	AIDS & CUES
• Flush inside of fuel tank with straight gasoline. Dispose of waste fuel correctly. • Check all ignition and on/off switch cables and connections.	
F. Storage The chain saw must be protected against chemicals and moisture during storage. 1. Drain fuel from fuel tank. Run engine at idle speed until it stops. Choke and start again. Run saw while choked to remove all fuel from the fuel line. Gas begins to break down after 1 month. This deteriorating gas produces a gummy substance called varnish, which clogs the carburetor, causing the saw to run poorly when it is started after long-term storage. 2. Turn fuel filler hole facing down, with fuel tank open, for 5 minutes. This will purge saw of fumes. 3. Remove saw chain and guide bar. Oil the bar. Soak chain in oil and store in oil or oiled paper. 4. Cover chain saw and store in cool, dry place. If saw is stored for a long period, turn saw monthly to redistribute oil on cylinder walls.	Slide 2-43

OUTLINE	AIDS & CUES
G. Chain Maintenance Chain maintenance is crucial to the performance of any chain saw. Before beginning any work assignment, follow four basic rules to maintain the saw chain for top performance and safe operation. 1. The chain must be correctly sharpened. When the chain is sharp, the chain does the work. When the chain is dull, you do the work, making you fatigued and increasing the wear on the bar, chain, and power head. 2. The depth gauges must be set correctly. The gauges' depths and shapes are critical to the saw's performance and your safety. 3. The chain must be tensioned correctly. More bar and chain problems are caused by incorrect chain tension than by any other single condition. 4. The chain must be well lubricated, using only bar and chain oil. The bar, chain, and nose need a steady supply of oil. Otherwise, the bar and chain will be subject to excessive wear and damage. Several conditions can increase the chain's potential for kickback, the risk of throwing or breaking the chain, or the risk of other hazards.	Slide 2-44

OUTLINE	AIDS & CUES
Look for these conditions when inspecting your chain saw: • Loose chain tension • Incorrect chain cutter angles (caused by improper filing) • Dull chain • Alteration of chain features designed to reduce kickback • Incorrect depth gauge (raker) settings (generally too low) • Improper shape of depth gauges (rakers) after filing • Incorrectly installed chain parts • Loose rivets, or cracks and breaks in any chain part • Chain stretched beyond usable limits. **HIGH BREAKAGE POTENTIAL:** Chain tension adjustment screw is maxed out (tightened as much as possible), so a drive link is removed to shorten the chain for more use.	

OUTLINE	AIDS & CUES
H. Chain Filing	Slide 2-45
This section focuses on chain filing with a round file and a clamp-on (handheld) file guide that clamps on the file, sometimes called a file holder. Using these files is the least complicated, least expensive, and most efficient way to file saw chain by hand in the field. Select a file that is the proper diameter for the saw chain, 7/32 inch is the most common size.	
After the saw chain has been hand filed a few times, it should be ground on a chain grinder to restore angles that may have changed during hand filing and to grind all cutters to the same length.	
Understanding how a cutter works will help you see why proper chain maintenance is so important.	
The depth gauge rides on the wood and controls the depth at which the cutting corner bites into the wood.	
The cutting corner and side plate sever the cross grains.	
The top-plate cutting angle (25-35 degrees) pushes the cutter to the side, creating the kerf. The chisel angle (directly under the top plate) chisels out the severed wood fibers, lifting them from the kerf.	Slide 2-46

OUTLINE	AIDS & CUES
Three angles must be maintained when filing or grinding a saw chain: Top-plate cutting angle, depth gauge setting, and side-plate angle. A clamp-on file guide maintains these angles. The angles may vary for different types of saw chains.	Slide 2-47
1. Sharpening cutters with a round file Be sure the chain is tensioned properly. The file must be held at least one-fifth of the file's diameter above the cutter's top plate. The clamp-on file guide (or jig) positions the file correctly. Maintain the correct top-plate angle (as marked on the file guide) by keeping the filing angle parallel with the chain. It may be easiest to sharpen cutters on one side of the chain first, filing from the inside of each cutter to the outside. Turn the saw around, and repeat the process for the remaining side. If the chrome surface of the top or side plates has been damaged, file until the chip has been removed from the chrome surface. Try to keep the length of all cutters equal.	Slide 2-48

OUTLINE	AIDS & CUES
2. How to set depth gauge (raker) height Use a depth gauge tool with the correct built-in setting for the chain. Place the tool on top of the chain so one depth gauge protrudes through the slot in the tool. If the chain depth gauge extends above the slot, use a flat file to file the depth gauge level with the top of the tool. Never file a depth gauge lower than the top of the tool. Depth gauge filing is generally required after three cutter sharpenings. After lowering a depth gauge, round off its leading edge.	Slide 2-49 through Slide 2-51
EXERCISE: Chain Saw Maintenance Purpose: To give students experience in basic chain saw maintenance. Time: 2+ hours Format: Students will work in small groups. Tasks for students to accomplish in the maintenance exercise: • Sharpen chain, free-hand with guide and with a file jig. Focus on chain condition, correcting damage and/or previous sharpening errors, and correct sharpening technique. • Ensure the chain is tensioned properly.	Slide 2-52 (video) Slide 2-53 Student Workbook, pages 2.22 – 2.24

OUTLINE	AIDS & CUES
• Maintain the correct top-plate angle (as marked on the file guide) by keeping the filing angle parallel with your chain. • File one side of the chain, then the other. • Keep the length of all cutters equal. • Set depth gauges (rakers) with a depth gauge tool. • Remove the bar and the chain, inspect them for damage and wear, clean them, and correctly tension. • Remove the clutch cover, needle bearing cage, and sprocket. • Identify chain brake assembly, clutch assembly, oiler pump mechanism, and spark arrestor. • Demonstrate the functions of the power switch, throttle interlock, choke, winter/summer air switch, etc. • Remove the air filter cover, and demonstrate cleaning procedures and choke operation. • Remove and clean (or replace) the fuel filter. • Inspect the power head for loose bolts and damage.	

OUTLINE	AIDS & CUES

- Remove the starter housing, and demonstrate repair and replacement of the starter mechanism and location of the cooling fan and anti-vibration mounts.

- Go through the black/gray check process.

Exercise Equipment and Materials (per group):

- Chain saw
- Owner's manual and safety manual for the brand of chain saw students will be using
- Bar wrench (scrench)
- Torx or allen wrench (saw brand size-specific)
- Files (round or flat) and hand-file guide
- Bar cover
- Depth gauge
- Power head wrench
- Short section of chipper chain
- Short section of chisel chain
- Short section of semichisel chain
- Rags
- Axes (3 to 5 pounds)
- Wedges
- Approved safety containers for fuel and oil

PPE:

- Hardhat
- Eye protection
- Hearing protection
- Gloves
- Long-sleeved shirt
- Pants long enough to cover boot tops
- Boots
- Saw chaps

OUTLINE	AIDS & CUES
Instructions: • Tell students they have 2 hours to complete the exercise and that they will work in their small groups. Guide students through the maintenance process by demonstrating and coaching. **End of Exercise.**	
III. CHAIN SAW TRANSPORTATION This section reviews the proper methods for transporting chain saws in a motor vehicle, when on foot, and by air.	
A. Transporting Chain Saws in a Motor Vehicle • Keep the bar and chain covered with a chain guard. • Properly secure the chain saw to prevent it from being damaged and to prevent fuel from spilling. • Never transport a chain saw or fuel in a vehicle's passenger compartment.	Slide 2-54
B. Transporting Chain Saws When on Foot • The muffler and power head can reach extremely high temperatures. Avoid contact with these areas when carrying a saw that has been used recently.	Slide 2-55

OUTLINE	AIDS & CUES

- When carrying the saw for short distances, more than two steps, let the saw idle down, and set the chain brake.

- When carrying the saw more than 50 feet (or in hazardous conditions such as on slippery surfaces or through heavy underbrush), turn off the saw and carry it in a way that prevents contact with the chain, muffler, and dogs.

- When carrying the saw on your shoulder, take extra care because of the sharpness of the chain and dogs. You must wear a long-sleeved shirt with collar turned up, gloves, and a shoulder pad. Make sure the bar, chain, and dogs are covered. There are many aftermarket bar covers available that also protect against the muffler. Do not use chaps to cover the bar and chain to avoid damaging the chaps.

C. Transporting Chain Saws and Fuel by Air

Refer to the latest edition of the Interagency Helicopter Operations Guide (NFES 1885) and Interagency Aviation Transportation of Hazardous Materials (NFES 1068) for current policy on air transportation of chain saws and fuel. See also 49 CFR, parts 171-175.

The U.S. Department of Agriculture, Forest Service, and the U.S. Department of the

OUTLINE	AIDS & CUES

Interior have an exemption from Department of Transportation regulations that allows transportation of hazardous materials, provided that the materials are transported in conformance with the agencies' handbook rules.

For aircraft transport in internal vented compartments, fuel containers must be marked as such, may not leak, must be tightly capped, and filled in a manner that allows vapor expansion.

Chain saws and fuel containers may be carried internally with fuel if:

- They are secured in an upright position that precludes spilling
- The compartment is ventilated and does not contain an exposed battery

Sigg and MSR fuel bottles must have an unvented cap in place, instead of a pouring spout.

If chain saws are to be transported in unventilated compartments, they must be purged. Fuel containers and fueled chain saws are not allowed in unventilated compartments.

OUTLINE	AIDS & CUES

Purging of chain saws:

1. Drain fuel tank.
2. Run engine until it stops.
3. Attempt restarting with choke on until engine fails to fire.
4. Remove fuel tank cap and invert engine for 5 minutes, when possible.
5. Replace cap.

Advise aviation personnel that you are transporting chain saws or fuel containers, or both, and obey their requirements.

Emphasize the following safety points. Remind students that a major portion of their evaluation is based on applying safe work practices.

IV. SAFE STARTING OF CHAIN SAWS — Slide 2-56

The methods to safely start and operate a chain saw vary with the make and model. However, the following safe practices should always be used:

- Drop-starting a chain saw is strictly forbidden. This is the most dangerous method of starting a saw because you have no control of the saw.

Demonstrate why drop-starting a chain saw is hazardous and forbidden by <u>simulating</u> a drop-start.

- Maintain a secure grip on the saw at all times.

OUTLINE	AIDS & CUES
• Always start the saw with the chain brake engaged.	
Demonstrate how the chain brake works on several types of saws.	
• Start the saw on the ground or where it is firmly supported. • Take extra care when starting the chain saw. Because you won't have both hands on the saw, you will need to be more careful to maintain complete control. Remember that the location and style of on/off switches may vary with different makes of saws. • Ensure that appropriate PPE is available and is worn correctly.	
This following section discusses starting procedures for chain saws. • **You may demonstrate other accepted methods that contain these basic principles using a non-running chain saw; the concepts can be presented in the classroom, and you can leave the demonstrations and practice for the field unit.** • **All students and instructors shall wear required PPE before starting the chain saw.**	
A. Starting a Chain Saw on the Ground • **Engage the chain brake.** • Place the saw on firm ground in an open area.	Slide 2-57 (video)

OUTLINE	AIDS & CUES
• Push in the decompression valve if the saw has one. • Grip the front handlebar firmly with your left hand. • Announce to bystanders that you are "STARTING UP." • Place the toe of your right foot into the rear handle and press down. • Pull the starter rope with your right hand. • Avoid allowing slack in the starter rope, which can lead to handle, rope, or recoil spring damage. Gradually return the starter rope to the chain saw housing. DO NOT allow the starter rope to snap back. • If the chain saw is cold, repeat pulling the starter rope as noted above until the saw "pops" once with the choke engaged. Switch to the partial choke setting, repeat until the saw fires. Once the saw starts running, tap the throttle trigger with your trigger finger; the saw will switch to idle on its own. Only disengage the chain brake after the saw is idling. • If the saw is warmed up, it may be started from the idle setting.	

OUTLINE	AIDS & CUES
B. Starting a Chain Saw Between Your Legs • **Engage the chain brake.** • Push in the decompression valve if the saw has one. • Announce to bystanders that you are "STARTING UP." • Place your left hand on the front handlebar at the point where it bends around the starting coil side of the saw. • Place the upper portion of the rear handle at the back of the right leg, tilting the saw to the right. Move the left leg over to firmly hold the saw against the right leg. • Pull on the starter rope, slowly pulling up until the starting mechanism engages. Then follow with a firm, quick pull of the rope. • Repeat and apply the applicable warm or cold choke settings as described in the Starting a Chain Saw on the Ground section. • **Do not** allow the starter rope to snap back. Gradually return the starter rope to the housing.	Slide 2-58 (video)

OUTLINE	AIDS & CUES
C. Starting a Chain Saw Over a Log or Stump • **Engage the chain brake.** • Pick an object to put the chain saw on that will allow enough clearance for the nose to slide forward. • Push in the decompression valve if the saw has one. • Lay the bar flat on the object. • Hold the starter rope in your left hand, which will be facing down, and hold the rear handle with your right hand. • Without touching the throttle trigger, slide the saw forward vigorously with your right arm, pulling the starter rope abruptly at the last moment of the slide. • Repeat until the saw fires. Follow the applicable warm or cold choke settings as described in the Starting a Chain Saw on the Ground section. • If the saw is warm, just use the idle setting, ensuring the chain brake is still on.	Slide 2-59 (video)

OUTLINE	AIDS & CUES
V. ADDITIONAL TOOLS AND SUPPLIES	Slide 2-60

Help students learn to identify various tools and supplies that are needed for chain saw operations.

- **Students also need to be able to determine whether the tools are in safe working condition.**
- **Discuss each tool with the class, including its proper care and maintenance.**
- **Have examples of tools that are in poor or unusable condition.**

A. Axes

Axes are used to remove bark from trees and to drive wedges during felling and bucking. The axe handle should be smooth and free of cracks. The head should be securely attached to the handle. Axes used for driving wedges should have a straight handle.

Axes need to be heavy enough (3 to 5 pounds) to drive wedges into the trees being felled. The back of the axe should be smooth, have rounded edges, and be free of burrs to minimize damage to wedges. Pulaskis should never be used to drive wedges.

Always remove branches, underbrush, overhead obstructions, or debris that might interfere with limbing and chopping. Do not allow anyone to stand in the immediate area.

OUTLINE	AIDS & CUES
Make sure workers know how far materials may fly. Protect all workers against flying chips and other chopping hazards by requiring them to wear the appropriate PPE. Always position your body securely while working with a tool. Never chop crosshanded (with your hands crossed); always use a natural striking action. Be alert when working on hillsides or uneven ground. If you cut a sapling that is held down by a fallen log, the sapling may spring back. Be alert for sudden breakage. If you do not have a need to cut something, leave it alone. Never use axes as wedges or mauls. Do not allow two people to drive wedges or chop on the same tree at the same time. When chopping limbs from a felled tree, stand on the opposite side of the log from the limb being chopped, and swing toward the top of the tree or branch. Do not allow the tool handle to drop below a plane that is parallel with the ground unless you are chopping on the side of a tree opposite your body. If the cutting edge picks up a wood chip, stop cutting. Remove the chip before continuing. To prevent blows from glancing off the wood, keep the striking angle of the tool head perpendicular to the tree trunk.	

OUTLINE	AIDS & CUES
Identify the different types of wedges shown on the slide and the types of applications they are used for.	
B. Wedges Wedges are essential tools for safe felling and bucking. They provide a way to lift the tree, preventing the tree from sitting back when it is being felled. A wedge must be inserted into the back cut as soon as possible. Wedges also reduce binds on the saw when bucking. Select the correct wedge for the job. The proper type, size, and length of a wedge varies, depending on its use. The size of the tree being felled or the material being bucked determines the size of the wedge that will be needed. If the wedge is too small, it may be ineffective. If the wedge is too long, it may not be able to do its job without being driven so far into the tree that it contacts the chain. Always drive wedges by striking them squarely on the head. When starting wedges, only drive them with enough force to seat them firmly. Drive them carefully to prevent them from flying out of the cut.	Slide 2-61

OUTLINE	AIDS & CUES

Check wedges daily or before each job. Do not use cracked or flawed wedges. Wedges that are damaged need to be repaired before they are used again.

Recondition heads and the tapered ends when grinding wedges to the manufacturer's original shape and angle. Wear eye protection and a dust mask.

Repair any driving tool or remove it from service when its head begins to chip or mushroom.

Carry wedges in an appropriate belt pouch or other container, not in the pockets of clothing.

Most wedges are made out of plastic or soft metal, such as magnesium, and come in different sizes. Use plastic wedges in both felling and bucking operations to prevent damaging the saw chain if it contacts the wedges.

The two basic types of wedges used in sawing are single and double taper.

1. **Single-taper wedges** are simple inclined planes designed to provide lift during tree felling. As the wedge is driven into the back cut, the tree hinges on the holding wood, redistributing the tree's weight.

OUTLINE	AIDS & CUES
The sawyer must coordinate striking the wedge with the **forward** sway of the tree, allowing the wedge to be driven more easily and sending less of a shock wave up the tree. Striking the wedge when the tree is in its backward sway sends a severe shock wave up the tree and can dislodge dead branches or tops, endangering the sawyer. Sawyers should look up after each blow to the wedge to avoid falling material. 2. **Double-taper wedges** are designed to reduce bind. They taper equally from the centerline, forcing the wood to move equally in both directions. They perform best when used in bucking to prevent the kerf from closing and binding the guide bar.	
C. Cant Hooks and Peaveys Although not generally found in fireline operations, cant hooks and peaveys are often needed for fire rehabilitation and project work. Both the cant hook and the peavey have a curved metal hook on the end of a straight handle to roll or skid logs. A cant hook has a blunt end or lip, whereas a peavey has a sharp, pointed spike at the lower end.	Slide 2-62

OUTLINE	AIDS & CUES
The cant hook is used primarily to roll logs. Peaveys are handy for prying logs up onto blocks to keep the saw from pinching while bucking. • Keep the handle of the cant hook or peavey free of splinters, splits, and cracks. • Keep all points sharp. • Keep your body balanced when pushing or pulling. • Grip the handle firmly. Do not overstress it. • Place a guard on the points when the tool is not in use.	
D. Fuel and Oil	
1. Fuel and oil containers The most commonly used fuel and oil container is the two-chambered (Dolmar type) safety container. Transport the container with all lids fully sealed. Empty the container thoroughly before storage.	Slide 2-63

OUTLINE	AIDS & CUES
Even empty fuel containers are dangerous. Large quantities of saw fuel must be transported in an approved safety can. • If a container is missing a lid or showing signs of a defect such as cracks, take the container out of service immediately. • All employees who handle, transport, or use flammable or combustible liquids shall receive hazard communication standards training and be familiar with Material Safety Data Sheets. • Passengers shall not ride in the enclosed cargo portion of a motor vehicle that is hauling flammable or combustible liquids. If it is absolutely necessary to carry flammable or combustible liquids in a motor vehicle, a minimal amount of such cargo shall be secured in a rack on the roof. • Never transport fuel in the same cargo area with oxidizers, acids, or radio equipment because escaped vapors may combine and explode, or electric currents may detonate vapors.	

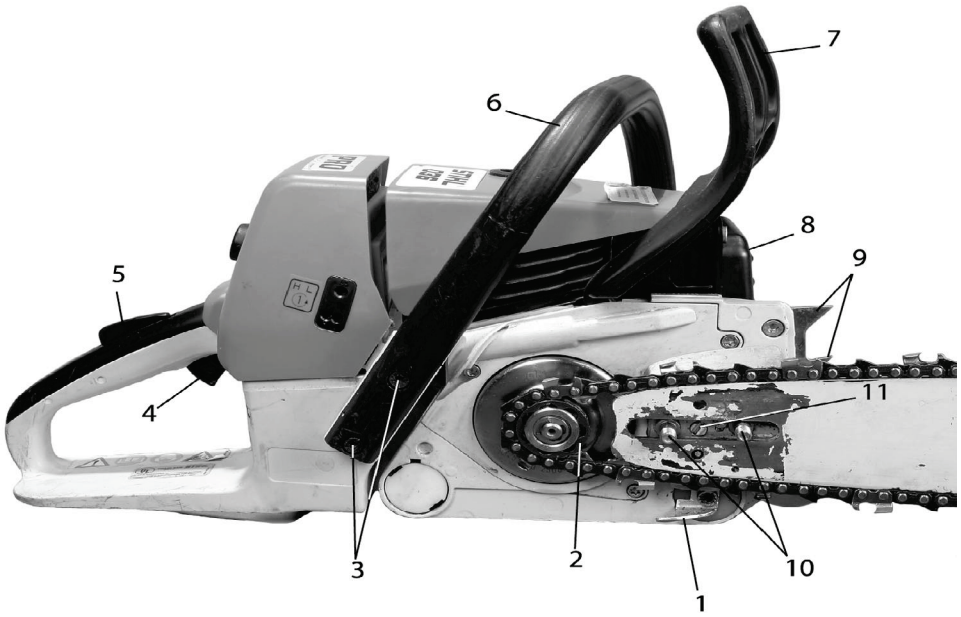
OUTLINE	AIDS & CUES
• Flammable or combustible liquids must be carried in approved safety containers as defined by the National Fire Protection Association (NFPA 30). Such containers must be clearly labeled to identify the contents. • Containers must never be filled more than 90 percent with fuel. Fuel vapors need room to expand. There have been many cases of the aluminum Sigg and MSR type bottles splitting open because they were overfilled. • Because the two-chambered (Dolmar type) safety container is not equipped with a spring-loaded lid that relieves pressure buildup, the container should be carefully vented when opened to avoid fuel splash.	
2. Fuel mixing Follow chain saw manufacturer's recommendations on the correct two-cycle engine oil-to-gasoline mixture. It is important to only use oils formulated specifically for use in chain saw engines to avoid maintenance and wear problems.	Slide 2-64

OUTLINE	AIDS & CUES
• Remove any dirt and oil accumulation from the fuel container. Inspect the container for interior contamination and cracks. Rinse the container with straight gas if necessary and dispose of it properly. • Always place the fuel container on a grounded surface at least 10 feet away from any ignition source. • Add the correct amount of two-cycle engine oil to the fuel container, then add the amount of gasoline required to obtain the proper oil-to-gas ratio for the chain saw. • Cap the fuel container and shake it to mix the oil and gasoline. • It is easiest to mix large batches of fuel (5 gallons or more) and then transfer the pre-mix to smaller containers for field use.	
3. Fueling a chain saw Fuel a chain saw only after the saw has cooled completely.	Slide 2-65
• Allow the saw to cool for at least 5 minutes before refueling.	Slide 2-66

OUTLINE	AIDS & CUES
• Fill the saw on bare ground or on some other non-combustible, grounded surface.	
• Immediately clean up spilled fuel.	
• Refuel outdoors and at least 20 feet from any open flame or other sources of ignition.	
• Although the order used to refill the fuel and oil tanks of the chain saw isn't critical, it is important to make a habit of doing it the same way every time to avoid filling a tank with the wrong fluid.	
Fill the oil tank first with the bar oil, and then fill the fuel tank with the pre-mixed fuel. Doing so will allow the power head to cool off before filling with fuel. Do not overfill either tank.	Slide 2-67
• Hand tighten the fuel and oil tank caps, being careful not to cross thread them.	
• Do not start the saw closer than 10 feet from the fueling area.	

OUTLINE	AIDS & CUES
Review unit objectives. **Present unit quiz.**	Slide 2-68

CHAIN SAW PARTS



1. **Chain catcher**
2. **Chain sprocket**
3. **Fasteners**
4. **Throttle trigger**
5. **Throttle interlock**
6. **Front handlebar**
7. **Chain brake**
8. **Muffler and spark arrester**
9. **Dogs (or bumper spikes)**
10. **Bar studs**
11. **Chain tension adjustment screw**

CHAIN SAW TROUBLESHOOTING CHECKLIST

Symptom	Possible Cause	Remedy
Engine will not start.	Start/run switch off.	Turn switch to ON position.
	Fuel tank empty.	Fill tank with correct fuel mixture.
	Throttle not in starting position.	Engage throttle.
	Choke not engaged.	Set choke on.
	Bad or stale fuel; water or dirt in fuel.	Empty tank and refill with correct fuel mixture.
	Flooded engine.	Remove spark plug. Dry and check gap. With switch and choke off, pull starter several times to purge excess fuel from cylinder. Reinstall spark plug and attempt to start with choke off.
If engine still won't start, check for spark.	Spark plug fouled or incorrectly gapped.	Remove spark plug. Attach to plug wire and ground spark plug to the cylinder.
If there is spark, but the engine won't start.	Fuel supply issue.	Set starter switch to run. Pull on starter cord several times and check for spark across plug gap. Clean and regap or replace spark plug.

CHAIN SAW TROUBLESHOOTING CHECKLIST

Symptom	Possible Cause	Remedy
No spark.	Spark plug or ignition wires shorted.	Repair or replace wires.
	Faulty switch wires.	Repair or replace.
Engine "pops" but will not run.	Carburetor needle jets out of adjustment.	Readjust carburetor (skilled mechanic or knowledgeable operator only).
	Fuel filter clogged or frosted over.	Clean filter (temporary) and replace when possible.
	Carburetor malfunctions (plugged jet, impulse hole, etc.).	Repair carburetor as needed (skilled mechanic or knowledgeable operator only).
	Water, ice, or dirt in fuel.	Clean or replace fuel filter, and drain tank.
Engine runs poorly and dies.	Fuel line kinked or partially plugged.	Clean or untwist line, replace, if necessary.
	Ignition wires short-circuiting or grounding.	Check all wire and connections and repair or replace.
Engine will not accelerate.	Low-idle fuel mixture needle jet screw set too lean.	Adjust carburetor.
	Chain too tight.	Readjust chain tension.
	Damaged carburetor fuel needle jets.	Repair or replace carburetor.
	Throttle linkage bent.	Straighten linkage.

CHAIN SAW TROUBLESHOOTING CHECKLIST

Symptom	Possible Cause	Remedy
Chain continues moving with throttle released.	Improper carburetor adjustment.	Readjust carburetor.
	Sprocket bearing worn out or dry.	Replace bearing.
	Broken or weak clutch springs.	Replace springs.
Erratic idling with little or no response to carburetor adjustments.	Loose carburetor.	Tighten carburetor.
	Air leak in fuel system.	Replace fuel line, and replace carburetor spacer.
	Air leak due to worn or damaged main bearing seals or crankcase, or cylinder gaskets.	Replace seals or gaskets.
	Fuel line fitting loose.	Replace fuel line.
	Cracked crank case.	Replace crank case.
Engine will not idle.	Incorrect adjustment of idle needle jet and/or idle speed screws.	Adjust needle jet screw(s).
	Clogged carburetor.	Clean carburetor.
	Fuel line clogged.	Replace fuel line.
	Throttle butterfly shutter in carburetor misaligned.	Align butterfly shutter.

CHAIN SAW TROUBLESHOOTING CHECKLIST

Symptom	Possible Cause	Remedy
Engine runs rich.	Carburetor needle jets adjusted improperly.	Readjust carburetor needle jets.
	Improper fuel mixture.	Mix fuel to manufacturer's recommendations.
Engine runs lean.	Carburetor fuel needle screws improperly adjusted.	Adjust fuel/air mixture with high-idle needle screw.
	Fuel tank vent or cap plugged.	Clean vent or cap.
	Leak in fuel line fittings between tank and carburetor.	Tighten or replace as necessary.
	Filter in carburetor or filter in fuel pick-up plugged.	Clean carburetor screen, and clean or replace fuel pick-up filter.
	Hole in fuel metering diaphragm or fuel pump diaphragm in carburetor.	Repair carburetor.
	Cracked crankcase.	Replace crankcase.
Engine loses power.	Dull chain.	Sharpen chain.
	Improper chain tension.	Adjust tension.
	Chain not oiling.	Clean oil port, and clean guide bar oil channel.

CHAIN SAW TROUBLESHOOTING CHECKLIST

Symptom	Possible Cause	Remedy
Engine loses power.	Clogged air filter.	Clean air filter.
	Dirty muffler and/or exhaust ports.	Clean muffler and/or exhaust ports.
	Dirty carburetor.	Clean carburetor.
	Dirty fuel filter.	Clean filter.
Engine overheats.	Cylinder fins clogged.	Clean fins.
	No oil in gasoline.	Empty tank, and refill with correct mixture.
	Two-cycle oil breaking down.	Use proper oil.
Restart difficult when saw is hot.	Fuel tank vent leaking.	Replace vent valve.
	Carburetor diaphragm or fuel pump leaking.	Repair carburetor.
Heavy smoke, low power.	Bar oil leaking oil into cylinder or crankcase.	Tighten crank case bolts or replace crank case gasket.
	Fuel mixture too rich for saw.	Drain fuel, and replace with correct mixture.

UNIT OVERVIEW

Course Wildland Fire Chain Saws, S-212

Unit 3 – Fireline Construction and Mop Up

Time 1½ hours

Objectives

1. Define the duties and responsibilities of the chain saw operator and the swamper.
2. Explain the tactical application of chain saws in fireline construction and mop up operations.
3. Describe methods of saw team deployment for fireline tactical strategy.
4. Describe methods for mop up and fireline rehabilitation.

Strategy

Using a combination of lecture, video, animation and written reference materials, instructor will lead students through a discussion.

Instructional Method(s)

- Lecture and discussion with PowerPoint presentation

Instructional Aids

☐ Computer with LCD projector, presentation software, and screen

Exercise(s)

- None

Evaluation Method(s)

- Unit quiz

Outline

I. Duties and Responsibilities of the Saw Team

II. Tactical Application

III. Tactical Deployment

IV. Mop Up and Fireline Rehabilitation

Aids and Cues Codes

The codes in the Aids and Cues column are defined as follows:

IG – Instructor Guide	IR – Instructor Reference
SW – Student Workbook	SR – Student Reference
HO – Handout	Slide – PowerPoint

UNIT PRESENTATION

Course Wildland Fire Chain Saws, S-212

Unit 3 – Fireline Construction and Mop Up

OUTLINE	AIDS & CUES
Present unit title slide.	Slide 3-1
Present unit objectives.	Slide 3-2
I. DUTIES AND RESPONSIBILITIES OF THE SAW TEAM	Slide 3-3 (video) Slide 3-4
The saw team consists of chain saw operators and swampers.	
A. Chain Saw Operator	Slide 3-5
1. Monitors fire:	
a. Establishes positive communication with swampers, crew, adjoining resources, and supervisor	
b. Ensures Lookout(s), Communication(s), Escape Route(s), and Safety Zone(s) (LCES) are in place	
c. Establishes cutting area control, ensuring no one is working below any bucking area and no one is within two and a half times the height of any tree to be felled	Slide 3-6

OUTLINE	AIDS & CUES
Lead a discussion of a variety of line construction requirements based on fuel type and fire behavior. Use chaparral, sage-juniper, and subalpine fir as examples. **You may provide an optional discussion of lessons learned on specific fire situations or of the geographic area where the course is presented.** **Advise students that when they are deployed outside their local area, they should not only ask about local fire behavior, but about chain saw operations safety and species considerations.**	
d. Applies appropriate line construction standards for fireline width, limbing height, safety zones, and Minimum Impact Suppression Techniques (MIST). This includes applying the direction found in the Incident Action Plan, or specific instructions from the Operations Section.	Slide 3-7
e. Adjusts line construction standards based on fuel type and fire behavior	
f. Makes line location decision when the location has not been flagged by a line scout	
g. Sets saw team's work pace for fireline construction	Slide 3-8

OUTLINE	AIDS & CUES
h. Cuts material to a size that is moveable by hand i. Safely moves between cutting locations	
2. Creates disposal sites for cut material: a. The decision on the disposal location is based on ease of disposal and line construction standards. b. Windows c. Keyholes d. Banking Caution should be used regardless of disposal method selected to avoid creating fuel jackpots with the potential to add to fireline intensity in the event of spotting.	Slide 3-9
3. Fells hazard trees if qualified to do so	
4. Bucks burning material during mop up	

OUTLINE	AIDS & CUES
B. Swamper	Slide 3-10
1. Assists with cutting area control and establishing fireline:	
a. Maintains LCES	
b. Acts as communication link for saw team by monitoring radio and assisting sawyer with cutting area control	
c. Clears fireline as an escape route	
d. Removes brush and slash	
e. Maintains fireline quality control standards	
f. Improves safety zones	
g. Identifies the need for or release of extra swampers	
h. Carries scraping tool, saw fuel, felling axe, and kit for sawyer	
The Sawyer and Swamper video shows a very well-coordinated hot shot team with good communication.	

OUTLINE	AIDS & CUES
2. Moves cut material along the fireline by: a. Dragging b. Chaining c. Banking d. Throwing	Slide 3-11 Slide 3-12 (video)
C. Terminology for Chain Saw Operator and Swamper Duties	
1. Windows − natural openings in the fuels, used as disposal sites for cut material	
2. Keyholes − openings cut into continuous fuels, used to dispose of cut material	Slide 3-13 through Slide 3-20 (video)
3. Banking − stacking of cut material on the side of the fireline opposite the fire edge	Slide 3-21 through Slide 3-26
4. Dragging − removing cut fuels away from fireline edge by dragging	
5. Chaining − removing cut fuels by handing material from one person to the next person in a line	
6. Throwing − removing cut fuels by throwing them away from the fireline. To avoid adding to fireline intensity, do not dispose of cut fuels	

OUTLINE	AIDS & CUES
within the fire. If it's black, it goes in the black, and if it's green, it goes out. For efficiency, partially burned materials can be cut.	
Lead discussion by asking students what they think might be a typical saw team deployment given their firefighting resources. For example, in some areas, U.S. Forest Service (USFS) engines make up all the saw teams, and local cooperators might be used as backup swampers or fireline diggers to support them.	Slide 3-27
II. TACTICAL APPLICATION	
A. Topographic Considerations	Slide 3-28
Terrain will often dictate line location, cutting area control, escape routes, and safety zones.	
• When cutting uphill fireline, ensure workers below the cutting area are warned and clear of bucking and felling operations to avoid being struck by rolling or sliding rounds and trees.	
• Apply the Downhill/Indirect Line Construction Guidelines (IRPG or Wildland Fire Incident Management Field Guide [PMS 410-1]). Consider completing the minimum fireline required to stop fire spread and then returning to remove larger material to avoid accidents from rolling or sliding hazards.	

OUTLINE	AIDS & CUES
Under- or overslung (sidehill) fireline requires the same cautions as above for cutting area control and safety.	
B. Tactical Considerations	Slide 3-29
Avoid any unnecessary felling. Identify and remove by felling only those trees that present a real hazard based on their condition: • On fire • Unsound snag or live tree • Severe lean • Hangup **Remember, hangup trees must be removed or flagged! Only remove hazard trees up to your skill level.**	
Fire-weakened trees should be identified and removed as soon as practical. Extra care should be taken in assessing the condition of the tree, particularly the hinge (holding) wood.	Slide 3-30
Always fell fire-weakened trees in the direction of their predominate lean. If the tree's complexity exceeds your comfort or skill level, flag the hazard area. In particularly dangerous situations like burned-out leaners, the use of mechanized equipment for removal is often preferred if it is available.	Slide 3-31

OUTLINE	AIDS & CUES
Never fell a tree when smoke obscures the top of the tree and prevents proper assessment. No felling should occur when top and lay cannot be observed. Pay attention to fire behavior, including spotting by wind, convection, gravity, and careless debris removal, while locating and constructing the fireline.	
C. Minimize Suppression Impacts	Slide 3-32 Slide 3-33
Using the Incident Response Pocket Guide (IRPG), discuss with students minimum impact suppression tactics and techniques and why they should be employed on every incident.	
Employ Minimum Impact Suppression Tactics (MIST) such as angle bucking logs to allow sections to be rolled back into their natural position after mop up, flush-cutting stumps, or locating fireline away from larger fuels. In wilderness areas, avoid all tree felling and bucking unless it is the minimum necessary action to achieve fire management objectives. Alternative tactics (such as using water, or natural fuel breaks to locate fireline) that minimize long-term disturbance of natural conditions are always preferred in wilderness.	

OUTLINE	AIDS & CUES
III. TACTICAL DEPLOYMENT	
A. Direct Attack	Slide 3-34
Tactical fireline location depends on topography, fuel type, and fire behavior. Only cut enough vegetation to control the fire. This lessens exertion and exposure time, and increases fireline production rate. Cut debris should be moved immediately to prevent surface fire spread. It is often advantageous to have a firefighter with a shovel to be part of the saw team. Any hot debris must remain within the fireline to prevent loss of fireline control. Locate fireline and remove larger fuels and brush to minimize fireline heat intensities for approaching firefighters. Swampers should stay alert for spotting, and identify escape routes and the need for safety zones as the fireline progresses.	
B. Indirect Attack	Slide 3-35
Indirect attack is frequently required in heavy brush or in timber with a heavy dead or down component where high fireline intensity or frequent spotting prevents direct attack. Ensure LCES is in place and followed. 1. Apply the Downhill/Indirect Line Construction Guidelines (IRPG or Wildland Fire Incident Management Field Guide [PMS 410-1]).	

OUTLINE	AIDS & CUES
2. Difficulty in holding the fireline often requires a change in tactics to indirect attack. Communicate with adjoining crews and your supervisor when tactics are modified.	
3. Crown fires often require removal of the canopy along the fireline to stop them. A minimum canopy clearance of 18 to 20 feet is required to prevent independent crown fire spread. A reduction of ladder fuels is also necessary to prepare indirect fireline from later crown fire activity.	
Because the workload is significant, multiple saw teams, crews, and mechanized equipment may be required to work together to establish an adequate fireline. Thorough planning and extra coordination is required to maintain cutting area control for each saw team in this situation.	
C. Initial Attack Tactics	
Small, initial-attack fires with a limited number of personnel to support containment efforts require good situational assessment and preparation before any personnel leave the vehicle.	
The sawyer and swamper should each carry a hand tool in addition to the chain saw, saw kit and fuel, felling axe, wedges, and radio.	Slide 3-36

OUTLINE	AIDS & CUES
If you are creating saw teams from different engines, ensure a good swamper briefing is done. Containing single-tree fires often requires that the saw team anchor and construct an adequate fireline to contain spread. The team must prepare a bed to drop the tree into to extinguish it. Drop the tree or snag as soon as possible to limit the chance of spots being thrown past the constructed line. Containing brush fires with limited resources may require that the swamper not only assist with brush pulling, but help dig line, too.	
D. Progressive and Leap Frog Line Construction For large fires, saw team deployment is either progressive or leap frog.	Slide 3-37 through Slide 3-45 Slide 3-46 (video)
• Progressive − Each saw team cuts a swath of fireline, with the lead team only cutting enough fuel to pioneer the fireline, and the following saw teams completing the fireline to standard with hand tools. Used when working in heavy, continuous fuels.	
• Leap Frog – The saw team cuts a chain of fuel and then bumps a chain ahead, followed by hand crews to complete the fireline. Works well in light fuels or during mop up.	Slide 3-47 through Slide 3-56 (video)

OUTLINE	AIDS & CUES
The leap frog technique is not advised when working in timber or heavy brush where the potential for danger could exceed the safety of a retreat to the black or a safety zone exists. When the leap frog method is used, lookouts are essential to maintain safety.	
IV. MOP UP AND FIRELINE REHABILITATION	Slide 3-57
The saw team's duties are to assist crews with mop up and rehabilitation operations and to mitigate aerial hazards. They accomplish this by:	
• Identifying and removing hazard trees, or flagging the hazard tree zone.	
• Facilitating crew access by cutting open burning logs, limbing, bucking downed trees, flush-cutting stumps, and cutting access trails for crews, equipment, and hose.	
• **Mop up is not a time for sport felling**. If it is not safe or necessary, do not fell any tree.	
• Maintain LCES. Mop up is a time for added vigilance to hazards, not complacency. Spend more time on safety briefings, ensuring hazard analysis is objective and thorough and that communications are maintained between personnel.	
• Saw teams can often help speed mop up by cutting burned portions of material that can later be put in bone piles.	Slide 3-58

OUTLINE	AIDS & CUES
• Fireline rehabilitation corrects the environmental disturbance that is created during fireline construction. In addition to the hand tool practices of pulling berms back into cut fireline, it is often necessary to employ branches, limbs, and bole wood to stabilize the fireline to prevent erosion. • If adequate material for fireline rehabilitation is not present, saw teams may be called upon to provide the material. • Consideration should be given to avoid "clear-cutting" an area. Instead, material should be cut from widely spread locations to minimize visual and environmental impacts. • Larger material is often used to divert water away from the disturbed soil along the fireline. Large limbs and logs may be needed to stabilize underslung line or to create check dams in drainages. • Contour, or cross-slope, felling of dead trees is frequently employed to stabilize soil along contours. The logs are staked in place and backfilled on the uphill side to collect soil and water to lessen slope erosion. Contour felling requires technically advanced skills and should not be attempted by apprentice sawyers.	

OUTLINE	AIDS & CUES
• In wilderness areas, techniques such as contour felling, or cutting and bucking material for rehabilitation operations, are generally not appropriate (unless there are no other less-impacting options). • Other techniques are preferred, such as returning any cut material to its original location and, if necessary, establishing log erosion control structures by making use of existing down woody material; flush-cutting stumps and staubs; and employing MIST to minimize the disturbance.	
Review unit objectives. **Present unit quiz.**	Slide 3-59

UNIT OVERVIEW

Course Wildland Fire Chain Saws, S-212

Unit 4A – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing

Time 2 hours

Objectives

1. Define the proper procedure for handling a chain saw.
2. Describe the proper procedure and hazard assessment for bucking, including types of binds and bucking methods.
3. Describe the proper procedure and hazard assessment for limbing.
4. Describe the proper procedure and hazard assessment for brushing and slashing.

Strategy

This unit will provide an introduction to prepare students for the field portion of the course.

Instructional Method(s)

- Lecture and discussion with PowerPoint presentation

Instructional Aids

□ Computer with LCD projector, presentation software, and screen

Exercise(s)

- None

Evaluation Method(s)

- Unit quiz

Outline

I. Handling

II. Bucking

III. Limbing

IV. Brushing and Slashing

Aids and Cues Codes

The codes in the Aids and Cues column are defined as follows:

IG – Instructor Guide
SW – Student Workbook
HO – Handout
IR – Instructor Reference
SR – Student Reference
Slide – PowerPoint

UNIT PRESENTATION

Course Wildland Fire Chain Saws, S-212

Unit 4A – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing

OUTLINE	AIDS & CUES
Present Unit 4A title slide.	Slide 4A-1
Present Unit 4A objectives.	Slide 4A-2
I. HANDLING	
A. Stance and Hand Position	
• Establish secure footing before operating a chain saw. Remove any ground debris that will not allow for stable footing.	Slide 4A-3
• Maintain a balanced stance with feet spread apart, knees bent, and back straight, and have a firm grip on the chain saw.	
• When cutting with a chain saw, do not overreach or lift or push with just your arms; use your legs, hips, and knees to turn your body.	Slide 4A-4
• Never operate a chain saw with one hand. Because you do not have control of the saw with only one hand, you increase the risk that you will be injured if the saw kicks back.	Slide 4A-5

OUTLINE	AIDS & CUES
• Chain saws are engineered for right-hand operation, and should be operated with the right hand controlling the throttle. Always grip the saw firmly with both hands, the left hand on the front handlebar and the right hand on the throttle and rear handle.	
• Place your fingers tightly around the rear handle and the front handlebar, keeping them between your thumb and forefinger.	
• Never cut with a chain saw when the throttle lock is engaged. If you do, you cannot control the saw or the chain speed. The cold-start throttle position used when the saw is cold automatically releases when the trigger is engaged.	
• Maintain cutting area control. Make sure your immediate work area is clear of people and obstacles, such as rocks, stumps, holes, or roots that may cause you to stumble or fall.	Slide 4A-6
• Make sure that the saw chain does not contact any materials such as rocks, dirt, or wire. Such contact is a safety hazard and will dull the chain. The chain will require filing, or it may be damaged in ways that filing cannot correct.	

OUTLINE	AIDS & CUES
B. Reactive Forces The laws of physics explain that for every action there is an equal and opposite reaction. These reactions happen very quickly during chain saw operation and can be dangerous.	Slide 4A-7 Slide 4A-8 (video)
Take time to discuss these reactions so students can understand why it is essential to hold and operate a chain saw correctly.	
1. **Kickback** is the most powerful reactive force you will encounter while operating a chain saw. Kickback can occur while felling, limbing, bucking, or brushing and slashing when the upper quadrant of the bar nose contacts a solid object or is pinched. During kickback, the bar is forced up and back in an uncontrolled arc toward the sawyer. Many factors determine the severity of the kickback and the arc such as: • chain speed • angle of contact • condition of the chain • speed at which the bar contacts the object	

OUTLINE	AIDS & CUES
Ways to avoid kickback: • Hold the saw with both hands, securely gripping the rear handle and the front handlebar between your thumb and forefinger. • Be aware of the location of the bar nose at all times. Accidently cutting with the top half of the guide bar nose is the most common mistake that causes kickbacks. • Never let the bar nose contact another object. • Never cut with the power head higher than your shoulder. • Never overreach. • Your stance should allow you to pull the saw smoothly out of the kerf when cutting. This technique will help to reduce kickbacks and fatigue. • Cut one log at a time. • Stand to the side of the kickback arc. Never rely on the chain brake to protect you from kickback injury.	

OUTLINE	AIDS & CUES

- Use caution when entering the bar into a partially completed cut.

- Use a properly sharpened and tensioned chain at all times.

- Watch the kerf and the log for any movement that may pinch the chain.

- "Lock" the left elbow in situations where kickback is likely, such as limbing.

- Use your attack corner of the bar when boring.

- Using a low-kickback chain can also minimize the chance of kickback.

2. **Pull-in** occurs when the chain on the bottom of the bar is caught or pinched, and suddenly stops. The chain pulls the saw forward.

   Ways to avoid pull-in:

   - Always start a cut with the chain moving at half or near full speed.

   - Watch the cut and the log for any movement that may pinch the bar. Use wedges to keep the cut open.

OUTLINE	AIDS & CUES
3. **Pushback** occurs when the chain on the top of the bar is suddenly stopped by contacting another object or by being pinched. The chain drives the saw straight back toward the sawyer. Ways to avoid pushback: • Only cut with the top of the bar when necessary. • Watch the kerf and the log for any movement that may pinch the top of the bar. • Do not twist the bar when removing it from a boring cut.	
II. BUCKING	Slide 4A-9
A. Proper Use of Dogs Learn to use the saw's dogs as a pivot point when felling or bucking. Use the dogs to support the saw's weight, not as a leverage point in an attempt to get the chain to cut faster. Proper use of dogs will enhance your control of the saw and improve the saw's efficiency while reducing fatigue.	
B. Situational Awareness	Slide 4A-10
1. Complete an overhead and ground hazard analysis.	
2. Never buck a tree that exceeds your ability.	

OUTLINE	AIDS & CUES
3. Ensure cutting area control is established for anything that could be affected by your cutting operation.	
4. Is the guide bar long enough for the log that is being bucked?	
5. Establish good footing.	
6. Swamp out bucking areas and escape routes. Anticipate what will happen when the log is cut.	
7. Plan the bucking cut carefully after considering:	Slide 4A-11
• Slope: people and property in the cutting zone.	Slide 4A-12
• Tension: limbs and spring poles, side of log under tension and possible log movement after the release cut.	
• Compression: falling or rolling root wads, side of log under compression and possible movement as release cut is completed.	
• Rocks and foreign objects on the log, and the log's tendency to roll, slide, or bind.	

OUTLINE	AIDS & CUES
• Pivot points: objects under the log that can allow it to swing around and strike the sawyer as the release cut is completed. Adjust the cutting plan to mitigate this hazard. Stand to the side of the cut to avoid the swinging end of the log. Ensure adequate escape routes are in place. Be aware of broken limbs, rocks, or other objects hidden underneath the log that can roll up to hit the sawyer.	
8. Complete a risk analysis before bucking:	
• Assess the area for overhead and ground hazards to be mitigated before beginning bucking.	Slide 4A-13
• Special hazards like leaners and snags need to be taken care of right away. Drop hazard trees to the ground so no one has to work under them.	
• Size up the log for tension and bind, and possible reaction after the release cut has been completed.	Slide 4A-14

OUTLINE	AIDS & CUES
• Establish escape routes and clear any obstacles that might inhibit your escape.	Slide 4A-15
• Identify and mitigate spring poles.	
• Cut slowly and observe the kerf for movement that will indicate where the bind is. A log can have different types of binds at different places.	Slide 4A-16
C. Safe and Efficient Bucking Techniques	Slide 4A-17
In most situations it is safest to buck logs from the uphill side unless the log might move uphill when bucked. This could occur because of the log's position, weight distribution, and pivot points.	
Always determine the number and type of binds and pivot points. Consult another sawyer if you have questions.	
Begin bucking by cutting the offside first. This is the side the log might move to when it is cut, usually the downhill side. This allows you to be farther away from the forces of the log that are generated when the log separates. Cut straight down until you have space for a wedge.	Slide 4A-18
Insert a wedge or wedges to prevent the cut (kerf) from closing tightly and pinching the bar.	

OUTLINE	AIDS & CUES
Understanding directional pressures—or binds—is important for safe and efficient cutting. These binds determine bucking techniques and procedures. Look for landforms, stumps, blowdown, and other obstacles that prevent a log from lying flat, causing binds. When a bind occurs, different pressure areas result. The tension area is the portion of the log where the wood fibers are being stretched apart. In this portion of the log, the kerf **opens** as the cut is made. The compression area is the portion of the log where the wood fibers push together. In this portion of the log, the kerf **closes** as the cut is made. It is extremely important to determine where the log may move when it is cut. Inspect the log for all binds, pivot points, and natural skids. Various bucking techniques can be used to lower a suspended tree to the ground. Always be prepared for unanticipated movement of the log or round as the release cut is completed.	
D. Determining Bind	Slide 4A-19
The four types of bind are: top, bottom, side, and end. There may be a combination of binds. Normally, logs have a combination of two or more binds. • Top bind - The tension area is on the bottom of the log. The compression area is on the top.	

OUTLINE	AIDS & CUES

- Bottom bind - The tension area is on the top of the log. The compression area is on the bottom.

- Side bind - Pressure is exerted sideways on the log.

- End bind - Weight compresses the log's entire cross section.

1. Bucking from the top down

    - It is best to start bucking at the top of the log and work toward the butt end, removing the binds in smaller material first. Look for broken limbs and tops above the work area.

      Never stand under an overhead hazard while bucking.

    - Look for small trees and limbs (spring poles) bent under the log being bucked. They may spring up as the log rolls away. If you can do so safely, cut these hazards before the log is bucked. Otherwise, move to a new cutting location and flag the hazard.

    - Determine the offside. The offside is the side the log might move to when it is cut—normally the downhill side. Watch out for possible pivots.

OUTLINE	AIDS & CUES
Clear the work area and escape paths. Allow more than 8 feet of room to escape when the final cut is made. Establish solid footing and remove debris that may hinder your escape. • Cut the offside first. If possible, make a cut about one-third the diameter of the log. This allows the sawyer to step back from the log on the final release cut, using only the forward portion of the guide bar. Do not let the nose of the bar pinch if the cut begins to close or to strike an object, causing kickback. • Watch the kerf to detect log movement. Position yourself so you can <u>detect</u> a slight opening or closing of the kerf. There is no better indicator of the log's reaction on the release cut. If the bind cannot be determined, proceed with caution. It may be necessary to move the saw back and forth slowly in the kerf to prevent the saw from getting bound as the kerf closes behind the guide bar. Cut only deep enough to place a wedge. Continue cutting. Watch the kerf. If the kerf	

OUTLINE	AIDS & CUES

starts to open, there is a bottom bind; if the kerf starts to close, there is a top bind.

- Reduce the remaining wood. Visually project the cut's location to the bottom of the log. Reduce the amount of wood for the final cut by cutting a short distance into the log along this line. Be prepared for kickback.

  The final cut, or release cut, will be made through the tension area. Because the offside has been cut, the sawyer only has to use enough bar to finish cutting the remaining wood. This allows the sawyer to stand back, away from the danger.

2. Using pie cuts

   On heavily loaded logs, a pie cut can be used to prevent dangerous reactive forces.

   A pie-shaped cut removed from the compression area can allow the log to settle slowly into this space, preventing dangerous slabbing and splintering. This practice is extremely important when cutting large logs.

OUTLINE		AIDS & CUES
	The location of the pie-shaped section and the release cut vary depending on the type of bind.	
3.	Working with top binds Cut the offside first; then partial cut on the compression side (top) finishing from the bottom, cutting up. With smaller logs, it is common to use only two cuts. Make the first cut on the top and have a slight rocking motion of the saw in order to cut more of the offside, followed by a release cut from the bottom. If using a pie cut, the first cut will still be the offside cut. Make the pie cut on the compression side (top). Then make a release cut from the bottom.	Slide 4A-20 (video)
4.	Working with bottom binds Cut the offside first; then make a partial cut on the compression side (bottom). Finish with the release cut on the top. With smaller logs, it is common to use only two cuts. The first cut will be on the bottom using a slight rocking motion of the saw in order to cut more of the offside, followed by a release cut on the top.	Slide 4A-21 (video/animation)

OUTLINE		AIDS & CUES
	If using a pie cut, the first cut will still be the offside cut. The pie cut will be on the compression side (bottom). The release cut will be on top.	
5.	Working with side binds If you are not certain the job is safe, do not make the cut. Normally, the offside is the side with tension; the tension side is usually bowed out (convex). Look for solid trees with no overhead hazards, and look for objects you can stand behind for protection while cutting. Remove a pie-shaped section from the compression area; then make the release cut in the tension area.	Slide 4A-22 (video/animation)
6.	Working with end binds Cut from the top down, inserting a wedge as soon as possible. Finish by cutting down from the top. Watch the wood chips to make sure that the chain is not cutting into the dirt (look for dark- or bark-colored chips).	Slide 4A-23 (video/animation)
7.	Working with blowdown Pay special attention when bucking in blowdown. Blowdown is a result of strong winds that have uprooted the trees. At any time while the bucking cuts are made, the tree's roots can drop back into place or the	Slide 4A-24 (video/animation)

OUTLINE		AIDS & CUES
	butt may roll. Consider the following points when bucking blowdown. If possible, start limbing and bucking the blown down tree from the top and work your way toward the stump or root wad. Limb and buck, observing normal assessments before beginning. Try to work small sections at a time, varying the length of each section based on the size of the tree being worked on. In general, the larger the diameter or length of the tree, the smaller the bucking section (keeping in mind the maximum size to make hand removal easiest). Small trees growing on the roots of blowdown could be forced into the sawyer's position if the roots drop or roll. Cut the small trees off the roots first. Limbs may be preventing the roots from rolling. Do not cut those limbs. The roots can move in any direction. Avoid standing directly behind or downhill from them.	
E.	Safe Bucking Practices Warn workers who are in or below an active cutting area. Allow workers time to move to a safe location. Verify their safety visually and verbally, and get confirmation back. Announce when a bucking operation has been completed.	Slide 4A-25

OUTLINE	AIDS & CUES
Never approach a cutting operation from below until the saw has stopped running, you have established communication with the sawyer, and the sawyer has granted permission to proceed. When bucking on slopes, place a block downhill to prevent rollout of the cut portion. Buck small sections that will be easy to control when they begin moving. Removing a single section of log may require that other binds be eliminated first. Angle bucking cuts, wide on top and made on the offside, allow a single section of log to be removed. Angled cuts will permit the bucked section of log to be rolled away from the remaining log.	Slide 4A-26
All logs must be completely severed when bucked. Flagging should be used to mark an incompletely bucked log as a hazard. Only one person should be cutting on a log at a time.	
F. Boring to Buck Boring is a bucking method that can be used when space is limited under a log. You should gain proficiency with other bucking cuts first before attempting this cut. • Ensure you have a stance that does not allow any part of your body to be in line with potential kickback.	Slide 4A-27 (video)

OUTLINE	AIDS & CUES
• Your front hand should be in line with the chain brake, with your thumb fully wrapped around the front handlebar, to prevent potential kickback. • Only use the attack portion of the guide bar when initiating the boring cut. • Maintain high chain speed and slow forward pressure to minimize bouncing of the bar within the kerf. • A slight twist of the front handlebar and rear handle can also help minimize the amount of chatter the chain saw experiences.	
G. Points to Remember	Slide 4A-28
• Do a complete sizeup. Identify the hazards, and establish your escape routes and safe zones. • Use rocks, stumps (if they are tall enough), or sound standing trees with no overhead hazards for protection in the event the tree springs sideways toward the sawyer when the release cut is made. • Binds change with log movement. Always reevaluate for binds after each section of the log is removed.	

OUTLINE	AIDS & CUES
• Allow the chain to be pulled through the wood; avoid using your dogs as a pivot point to force the chain through the cut. • Only stand as close to the log as needed during your release cut.	
III. LIMBING The following safety precautions must be strictly adhered to when limbing; noncompliance could result in a serious injury or fatality.	
A. Check for overhead and ground hazards before any limbing begins. If a specific portion of the tree you are limbing has any overhead hazards, leave that portion of the tree unlimbed.	Slide 4A-29
B. Check for objects on the ground such as stumps, logs, and spring poles that may be hidden by the limbs of the felled tree. If the nose of the bar inadvertently strikes an object, the saw may kick back.	
Using a chain saw, demonstrate what is meant by "crossing over" the hands and the dynamics of the kickback arc.	

OUTLINE	AIDS & CUES
C. Maintain a firm grip on the saw with your thumb wrapped around the front handlebar during all limbing activities, regardless of the direction in which the saw is turned. • Lock the left elbow, and stand to the side of the kickback arc.	Slide 4A-30
D. Identify the direction the log may roll or move when the limbs are removed, and avoid being in the path of the log. • Be sure you have firm footing as you are limbing. • Do not step forward until the limbing cut is complete.	
E. Identify the limbs that are supporting the tree's weight. • Do not attempt to cut those limbs off in a manner that would allow the tree to roll or strike you. • Plan to remove these limbs last in an order that allows the tree to make a slow, controlled fall to the ground. • Whenever you are given the opportunity to safely buck a portion of the tree off, do so to reduce the weight of the tree. • Always plan and clear an escape route for each individual cut.	

OUTLINE	AIDS & CUES
F. When limbing a log, it is recommended that sawyers limb one side out to the top before turning around and limbing the other side on their way back (as appropriate). • Another option is to limb a tree out in sections. It is advisable to limb the far side of the log first, resting the saw's weight on the bole, keeping the bole between the bar and the sawyer as added protection. • Crossing over the hands when limbing could result in injury. • Sawyers should select chain saw power head and bar length combinations based on their physical ability to manage the saw. Bar length should be appropriate for the cutting task based on the size and type of material to be cut. • Bend at the knee and hips to maintain good body balance. Avoid bending at the waist to reduce back fatigue.	Slide 4A-31 Slide 4A-32 (video)
G. Limbing kickbacks occur when the upper quadrant of the bar nose contacts an object and the chain is stopped. • The rotating force of the chain is transferred to the saw body in a direction away from the cut.	

OUTLINE	AIDS & CUES
• Keeping the saw speed up minimizes the chance of the teeth grabbing. • Chance of injury depends on how well the sawyer maintains control of the chain saw, or if their body is positioned out of the kickback arc. • To reduce the chance of cutting the chaps or legs when limbing, only step forward when the chain has stopped moving, or when the guide bar is on the opposite side of the stem or log. • Overreaching is generally the cause of limbing kickbacks. The shorter the bar, the more severe the kickback. Modern saws are equipped with an inertial brake that automatically engages the chain brake before the hand guard reaches the hand. • The chain is more likely to be thrown when you are working with small material. Check the chain tension often. Sawing close to the ground increases the chances of kickback and damage to the chain. Watch out for rocks and other debris.	
H. Spring poles are limbs or small trees that are bent over and are under extreme tension.	Slide 4A-33 Slide 4A-34 (video)

OUTLINE	AIDS & CUES

Spring poles are encountered frequently when limbing. They can cause serious injury.

If spring poles are not cut properly, they can spring back and strike the sawyer or throw the chain saw back into the sawyer.

Discuss spring poles. Bend a stick to illustrate the tension and compression of a spring pole.

Sawyers must recognize spring poles and use the proper technique when cutting them. One of two methods may be used:

1. Stand back at a safe distance. Make a series of shallow cuts less than ½ of the spring pole's diameter in the compression side and roughly ½-inch apart.

   As soon as movement or pinch is detected, remove the saw and begin the next cut. Four to six cuts should be sufficient.

   The release cut is then made from the tension side, about ½-inch past the cuts toward the small end of the spring pole. Stand back and stay clear of the pole as the final tension is released.

2. Stand back at a safe distance and shave (or cut) with the compression arc of the spring pole, only cutting in the width of the saw chain.

OUTLINE	AIDS & CUES
Once the spring pole starts to move, step away from it as it breaks. After the pressure is reduced, make the release cut in the tension side of the spring pole.	
I. Sometimes a tree is suspended off the ground by the limbs underneath or by uneven terrain.	Slide 4A-35
• The sawyer must decide whether or not to limb the tree after considering the potential that the sawyer might fall or that the tree may roll or collapse.	
One of the most important choices is deciding if you can work safely and, if so, where to make the first cut.	
• Consider footwear and environmental conditions such as rain, snow, fog, or darkness, and the ability and experience of the sawyer.	
• Carefully select the appropriate technique, such as limbing from the ground, limbing on top, or lowering the tree by bucking.	
IV. BRUSHING AND SLASHING	
A. Sizeup and Safety Considerations	
Many sawyers have cut their chaps or their legs when they took a step toward the next tree. Be sure the chain has stopped before moving to the next cutting location.	Slide 4A-36

OUTLINE	AIDS & CUES
Engage the chain brake when moving even short distances. Never rest the bottom of the power head against your leg, only the power head's sides. Shut the saw off before moving farther than from tree to tree, before moving more than 50 feet, and when hazardous conditions exist (slippery surfaces or heavy underbrush). When slashing (felling) trees smaller than 5 inches in diameter, an undercut may not be needed. Instead, a single horizontal cut one-third the diameter of the tree may be used to fell it, finishing with a horizontal cut from the back. A good rule to follow is to undercut any tree that can't be picked up with one hand. When directional felling is necessary, use an undercut (see the felling section). Situations when you should use directional felling of small trees include: • A potential barber-chair situation • A closed canopy • Tree defects • Side binds • Environmental damage **Other Safety Considerations**—Always escape (retreat from) the stump quickly even when felling small-diameter trees. They can cause serious injuries and fatalities.	Slide 4A-37

OUTLINE	AIDS & CUES
Trees should be pushed over only by the sawyer, only when the sawyer can do so safely, and only after the sawyer has looked up for overhead debris that could become dislodged.	
B. Safe and Efficient Brushing and Slashing Techniques	
In dense fuel accumulations, the nose of the guide bar may accidentally bump (stub) into a limb, causing kickback. The sawyer must continually be alert for kickback.	Slide 4A-38
The sawyer normally will have a swamper (puller) working nearby helping to remove cut debris. The swamper's safety must be taken into consideration.	
It is the sawyer's responsibility to maintain cutting area control and to communicate their intentions to the swamper. A system of non-verbal communication must be worked out to ensure the safety of the sawyer-swamper team.	
Proper stance and saw handling is imperative. In addition, the following steps should be taken.	
• **LOOK UP** for widow-makers and other loose debris. Do not cut under a hazard. Remove the hazard, if possible.	Slide 4A-39
• Watch out for whipping limbs and branches when cutting smaller material. Cut close to the stem.	

OUTLINE	AIDS & CUES
• Begin and complete cuts with a sharp chain and high chain speed.	
• Cut limbs and stems flush with the trunk or close to the ground. Do not leave staubs (pointed stems) that could cause injury during a fall or cause the sawyer or others to trip.	
• Do NOT cross your hands over on the chain saw handles. Keep some distance between your legs and the guide bar. Bend down to maintain distance. Cut on one side, then the other to avoid crossing the chain saw in front of you.	Slide 4A-40
• Never cut with the chain saw above shoulder height. Control is difficult when the saw's weight is above your shoulders. A thrown chain could strike you in the face or upper body.	Slide 4A-41
• Clear debris from the cutting location to prevent the guide bar nose from accidentally stubbing the debris or launching cut debris back towards you. When you are removing debris, engage the chain brake or turn off the ignition.	
• Watch out for spring poles. Do **not** cut spring poles if you can avoid doing so.	

OUTLINE	AIDS & CUES
• When cutting a heavy limb, consider using a small cut opposite the final cut to prevent the material from slabbing or peeling off. • Pay special attention if you are working in close quarters with other workers in an area with steep slopes and thick brush or logging slash. – First, stop and size up the situation. Make a plan and talk it over with all workers in the area. A well thought-out plan saves time and reduces the risk of accidents. – After you have discussed the plan, work systematically from the outside in and from downhill up. This reduces the chance that material will hang up. – Maintain a space between workers that is no less than two times the height of the tallest tree. • You need one or more escape routes, even when felling small trees. • School-marm's are hazardous because they present a high potential for causing kickback. Watch that bar nose!	

OUTLINE	AIDS & CUES
• When cutting small trees, cut the stumps as close to the ground as possible without hitting the ground with the chain. Stumps are cut low so they will not be as noticeable and will present fewer hazards to people.	Slide 4A-42
• Small trees can be limbed while they are standing. Do not cut with the chain saw above shoulder height. Limbing the bottom of small trees allows the sawyer to move in closer to the bole when felling it, and will help the sawyer watch the nose of the bar to prevent kickbacks.	
• To help prevent throwing chain, draw the saw back towards you as you start the cut, and maintain chain speed. Sudden stops to the chain near the nose often derail the chain from the bar.	
• Remember, when you saw up from the bottom (using the top of the bar) the saw will push back rather than pull away. This increases the risk of kickback and loss of control.	
• Be aware of signs of fatigue such as more frequent kickbacks, bar pinches, and near misses. Take a break at the first signs of fatigue.	

OUTLINE	AIDS & CUES
Explain the potential for injury from operating a chain saw when fatigued.	
• Cut pieces small enough so they are easy to lift and handle by hand. Lift properly using the legs and keeping the back straight.	Slide 4A-43 Slide 4A-44 (video)
• Swampers must anticipate the sawyer's movement and the movement of the chain saw, be aware of their own footing and escape routes, and watch out for flying debris.	
We recommend that you proceed with Unit 4B to develop skills with chain saw handling and bucking, limbing, and brushing and slashing to ensure students can efficiently handle a saw before you present Unit 4C.	
Review Unit 4A objectives. **Present Unit 4A quiz.**	Slide 4A-45

UNIT OVERVIEW

Course Wildland Fire Chain Saws, S-212

Unit 4B – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (Field Proficiency)

Time 30 minutes classroom and 4-8 hours field, depending on class size

Objectives

1. Demonstrate competence in safely handling, bucking, limbing, and brushing and slashing in the least complex situations.
2. Demonstrate safe cutter and swamper interaction.

Strategy

Students will practice handling, bucking, limbing, and brushing and slashing techniques learned in the classroom and gain proficiency in operating a chain saw through field exercises.

The instructor should be sure to set up a simple reactive-forces bucking experience.

Instructional Method(s)

- Short introductory lecture followed by field exercise

Instructional Aids

☐ Computer with LCD projector, presentation software, and screen

Exercise(s)

- Field proficiency exercise

Required Personal Protective Equipment (PPE) for Each Instructor and Student

See the Instructor Reference (IR 4B-1) at the end of this unit.

Tools Required for Each Student Group

See the Instructor Reference (IR 4B-1) at the end of this unit.

Evaluation Method(s)

- Instructors and field evaluators will evaluate students using the Chain Saw Operator Field Evaluation Form.

Outline

I. Field Exercise Responsibilities

II. Conducting Field Training for Sawyers

III. Skill Demonstrations

Aids and Cues Codes

The codes in the Aids and Cues column are defined as follows:

IG – Instructor Guide	IR – Instructor Reference
SW – Student Workbook	SR – Student Reference
HO – Handout	Slide – PowerPoint

UNIT PRESENTATION

Course Wildland Fire Chain Saws, S-212

Unit 4B – Chain Saw Tasks and Techniques: Handling, Bucking, Limbing, and Brushing and Slashing (Field Proficiency)

OUTLINE	AIDS & CUES
Present Unit 4B title slide.	Slide 4B-1
Present Unit 4B objectives.	Slide 4B-2
The instructor (and field evaluators) will work with the students in a field environment using the techniques and procedures taught in the classroom.	
Students will perform handling, bucking, limbing, and brushing and slashing under the guidance of a qualified instructor and will be evaluated on their skill level.	
I. FIELD EXERCISE RESPONSIBILITIES	
A. Instructor Responsibilities	Slide 4B-3
• Instructor (and field evaluators) must take an active role in training and evaluating the students.	
• Instructors need to demonstrate the skills properly and work with the students to ensure that they gain the skills needed to operate chain saws safely.	

OUTLINE	AIDS & CUES
• Instructors need to make honest, constructive assessments when evaluating students, using the Chain Saw Operator Field Evaluation Form (in Appendix C). The instructor is responsible for evaluating whether the students have the skills to do the work safely. If the students don't have those skills, the instructor should document the additional training needed on their Chain Saw Operator Field Evaluation Form. • Students must understand that further training may be required before sawing in different regions because of the differences in tree species, wood properties, tree sizes, and topography. • During the field training sessions, safety should be the number one concern of instructors and students. Something can always go wrong during skill-related training. Instructors must do a thorough job of planning before beginning the field training sessions. • The instructor must ensure cutting area control for their own group and between groups. Be aware of the activities taking place in all cutting areas. Ensure that students follow correct safety procedures at all times.	

OUTLINE	AIDS & CUES
• The instructor must also discuss the safety procedures to follow in case of an accident: – When selecting a cutting area, determine the needs of the students. Work with local resource staff to locate a site that is suitable, has good access, and does not have safety hazards that cannot be mitigated. Obtain all proper clearances through the environmental analysis process. – Recommended ratio for the field exercise is no more than three students per instructor or field evaluator. – A job hazard analysis that includes first-aid procedures and emergency evacuation plans will be prepared in advance and discussed with the students. Use the hosting agency's safety and health handbook and safety information in this unit to help develop these plans.	

OUTLINE	AIDS & CUES
– Conduct a tailgate safety session that includes all safety aspects of the field proficiency exercises, first-aid procedures, and emergency evacuation plans. – Ensure that all students have all safety items listed on the Chain Saw Operator Field Evaluation Form.	
B. Student Responsibilities Students must have all PPE and tools for the field exercise. • Take responsibility for your safety and for the safety of all other participants. • Demonstrate cutting area control. • Ask for clarification on task completion. • Review the JHA/RA. • Participate in tailgate safety sessions. • Correctly use all required PPE.	Slide 4B-4 through Slide 4B-9 IR 4B-1 SR 4B-1, Student Workbook, page 4B.7

OUTLINE	AIDS & CUES

II. CONDUCTING FIELD TRAINING FOR SAWYERS

A. Secure the Cutting Area

Many safety issues can be addressed by establishing a secure cutting area.

- On hillsides with steep slopes, the entire downhill side will be included in the secure area.
- No one shall be allowed in the secured cutting area without authorization by the sawyer and instructor.
- One person shall be responsible for maintaining reliable communications with the sawyer and with people in the safety zone to ensure that no one enters the secured cutting area.
- A road or trail guard may be set up on all roads and trails entering and leaving the secured cutting area. This will prevent members of the public or other employees from entering the area.
- Effective communication must exist between the guards and the sawyer.

To protect the lives of employees, contractors, and the public, the sawyer must adhere to these standards. Instructors and all students must understand and follow these standards.

OUTLINE	AIDS & CUES
B. Monitor the Cutting Procedures The instructor will monitor cutting procedures and take corrective actions or discontinue cutting if problems develop. Common problems include: • Stance – moving feet while cutting • Being in line with potential kickback • Incorrect thumb placement on the front handlebar • Movement of front hand while chain is spinning • Improper chain brake use • Not monitoring kerf for proper bind determination • Wedging too late or other improper wedging • Over- or under-reaching	
III. SKILL DEMONSTRATIONS The following tasks will be accomplished with a gasoline-powered chain saw equipped with a 16- to 24-inch straight guide bar and all required PPE. The field evaluation form will be used to document the process.	Slide 4B-10

OUTLINE	AIDS & CUES
A. Handling, Bucking, Limbing, and Brushing and Slashing The students shall:	
• Demonstrate the approved chain saw starting methods.	Slide 4B-11
• Demonstrate the ability to analyze and mitigate overhead and ground hazards associated with limbing, bucking, and brushing and slashing.	
• Given a standing tree with limbs near the ground in a closed stand of timber, the student will properly size up, clear the work area, and limb the tree to the height of their head.	
• Given a brush field, the student will properly size up, clear the work area, and cut and remove a strip of brush to near ground level 6 feet wide by 20 feet long.	
Some areas may not have suitable brush fields to complete this task. The lead instructor may substitute equivalent additional practice in limbing and bucking to evaluate the student's judgment and skill in chain saw use.	
• Given a prepared sound stump (12 to 18 inches in diameter), the student will execute a horizontal bore cut through the stump that varies no more than 3/8-inch in width from the point of beginning to exit.	Slide 4B-12

OUTLINE	AIDS & CUES
Note: the student must practice this task while in the presence of an instructor. (If the student cannot successfully complete a bore cut, document it in the evaluation.) • Given a downed tree on a slope up to 30 percent, the student will properly size up, clear the work area, and buck and limb the tree into lengths suitable for hand removal.	
B. Demonstrate Safe Cutter and Swamper Interaction • Identify one person to be the primary swamper. This is the only person allowed to enter the blood bubble. • The primary swamper should concentrate on clearing cut material away from the sawyer's path. Additional swampers could be used to bank or throw cut material. • A procedure for communication should be agreed upon between the sawyer and the swamper that includes verbal and nonverbal communication, tactics, and responsibilities.	Slide 4B-13
Review Unit 4B objectives.	Slide 4B-14

ITEMS NEEDED FOR UNIT 4B

Required PPE for each instructor and student:

- ☐ Approved hardhat (full brim or cap style).
- ☐ Wrap-around eye protection (safety glasses or shield).
- ☐ Hearing protection (ear plugs or muffs, approved for 85 decibels and higher).
- ☐ Gloves (slip- and cut-resistant and appropriate for the weather conditions).
- ☐ Long-sleeved shirt appropriate for the weather conditions.
- ☐ Pants (loose fitting and long enough to cover boot tops). Do not cut (stag) fire pants to shorten them.
- ☐ Heavy-duty, 8-inch-high, laced, water-resistant leather boots (cut-resistant, with ankle support and non-slip soles, appropriate for the weather conditions).
- ☐ Approved chain saw chaps (chaps should overlap boot tops by at least 2 inches).
- ☐ Appropriate first-aid kit. Employees should carry their own surgical gloves.
- ☐ Require students to wear standard fireline clothing and PPE.

Tools required for each student group:

- ☐ Single-bit axe with a 3- to 5-pound head and sheath (straight handle is recommended).
- ☐ Plastic wedges (appropriate length to match the tree diameters).
- ☐ Approved gas and oil containers.
- ☐ Approved belt fire extinguisher (if required).
- ☐ Whistle or other signaling device.
- ☐ Appropriate tool kit with spare parts.
- ☐ Tool belt.
- ☐ Wedge pouch.
- ☐ Chain saw in proper working order.
- ☐ Appropriate communication device (radio or cell phone).
- ☐ Extra saw chain (correctly filed and maintained).
- ☐ For the field exercise, students must have a copy of the course JHA listing all emergency evacuation and communication procedures.

UNIT OVERVIEW

Course Wildland Fire Chain Saws, S-212

Unit 4C – Chain Saw Tasks and Techniques: Felling

Time 3 hours

Objectives

1. Describe the five elements of the tree felling process.
2. Identify common felling techniques and when each one is appropriate.
3. List the steps of a procedure for felling a tree.
4. Identify three methods to mitigate leaners and hangups.
5. List four elements of a stump analysis.

Strategy

This unit is designed to prepare students for the field exercise (Unit 4D) by showing them a variety of felling techniques on video and thorough discussion with the instructor.

Instructional Method(s)

- Lecture and discussion with PowerPoint presentation

Instructional Aids

□ Computer with LCD projector, presentation software, and screen

Exercise(s)

- None

Evaluation Method(s)

- Unit quiz

Outline

I. The Tree Felling Process

II. Tree Felling Techniques and Procedures

III. Leaners and Hangups

IV. Stump Analysis and Low Stumping

Aids and Cues Codes

The codes in the Aids and Cues column are defined as follows:

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UNIT PRESENTATION

Course Wildland Fire Chain Saws, S-212

Unit 4C – Chain Saw Tasks and Techniques: Felling

OUTLINE	AIDS & CUES
Present Unit 4C title slide.	Slide 4C-1
Present Unit 4C objectives.	Slide 4C-2
To prepare for the following section, the instructor should visit the Hazard Tree Safety website (http://www.nwcg.gov/branches/pre/rmc/htsc/index.html). **The site provides additional information on hazard tree identification and related topics important to delivering the following section.**	Slide 4C-3
This unit covers the tree felling process, techniques, and procedures.	
I. THE TREE FELLING PROCESS This section explains the process common to all types of tree felling.	
The process of felling trees is made up of five basic elements: • Performing a sizeup and creating a felling plan • Establishing cutting area control • Making the undercut	Slide 4C-4

OUTLINE	AIDS & CUES
• Making the back cut with wedging • Exiting safely	
A. Performing a Sizeup and Creating a Felling Plan	
1. Situational Awareness and Hazard Assessment	
Analyze the felling job by considering:	Slide 4C-5
• Issues with tree characteristics • Problems with soundness or defects • Defects in the base of the tree • Issues with surrounding terrain • Immediate work area	
Issues With Tree Characteristics	Slide 4C-6
• Species • Live or dead • Sound or soft • Widow-makers or hangups	
• Diameter and height • Frozen wood • Heavy branches or uneven weight distribution	Slide 4C-7
• Direction of lean(s) • Degree of lean (slight or great) • Head lean or side lean • Stand health	Slide 4C-8

OUTLINE	AIDS & CUES
Problems With Soundness or Defects	
• Deformities, such as those caused by damage from weather, lightning, or fire	Slide 4C-9
• Spike top	Slide 4C-10
• Nesting or feeding holes	
• Cat face	
• Splits and frost cracks	Slide 4C-11
• Bark and trunk soundness	
• Twin or devil top or schoolmarm	Slide 4C-12
• Deformities, such as those caused by mistletoe	Slide 4C-13
• Rusty (discolored) knots	
• Punky (swollen or sunken) knots	
• Unstable root system or root protrusions	
• Wounds or scars	Slide 4C-14
• Split trunk	
• Human-made hazards	
Defects in the Base of the Tree	
• Thud (hollow) sound when struck	Slide 4C-15
• Insect activity	
• Conks and mushrooms	Slide 4C-16
• Feeding holes	
• Rot or cankers	
• Bark soundness	Slide 4C-17
• Shelf or “bracket” fungi	
• Resin flow on bark	
• A swollen base, indicating potential for hollow bole in hardwoods	

OUTLINE	AIDS & CUES
Issues With Surrounding Terrain	Slide 4C-18
• Steepness • Stumps • Irregularities in the ground • Loose logs • Draws and ridges • Ground debris that can fly or kick up at the sawyer • Rocks	
Immediate Work Area (Things to Look for)	Slide 4C-19
• People, roads, or vehicles • Reserve trees (signed to mark administrative boundaries and location monuments) • Power lines or fences • Underground utility lines • Structures	
• Hangups and widow-makers • Openings to fell trees	Slide 4C-20
• Other trees that may be affected • Snags • Fire-weakened trees • Other trees that may have to be felled first • Hazards such as trees, rocks, brush, low-hanging limbs • Footing	Slide 4C-21

OUTLINE	AIDS & CUES
Click image on the slide to play the Sizeup video. Use a laser pointer to clearly identify the stand hazards and discuss with students. The hazard tree area shown covers no more than ¼ acre.	Slide 4C-22 (video)
2. Complexity Before starting the saw, the chain saw operator must evaluate if a tree is safe to cut. Other options are always available. **IF YOU DETERMINE THAT FELLING A PARTICULAR TREE WILL BE TOO DANGEROUS, DON'T DO IT!**	Slide 4C-23
Emphasize to students that all tree felling involves a risk management decision. The sawyer must determine the safest process, which may be to turn down the cutting assignment and walk away.	Slide 4C-24
In terms of complexity vs. size, a faller should not rely on tree size alone to determine complexity. Hazards found in small trees can make them more dangerous than larger trees. Complexity will trump size.	Slide 4C-25 (video)

OUTLINE	AIDS & CUES
Common factors that can make small trees more complex include: • Less room for error. • Less room for wedging. • Vibrations having greater effect over the length of the tree. • Complexity may be underrated due to small size. Debris falling from above causes over one-half of all felling accidents. Practice watching overhead while cutting, with occasional glances at the saw, the kerf, and the top of the tree. **Observe the top** – When you approach the tree to be felled, observe the top. Check for all overhead hazards that may come down during felling. Look at the limbs. Are they heavy enough on one side to affect the desired felling direction? Are the limbs entangled with the limbs of other trees? If so, they will snap off or prevent the tree from falling after it has been cut. Is the wind blowing strongly enough to affect the tree's fall? Remember that surface wind speeds <u>are less</u> than those 20 feet and above the surface.	Slide 4C-26

OUTLINE	AIDS & CUES
Wind speeds greater than 15 miles per hour may require that felling be stopped. Strong winds could also blow over other trees and snags in the area. Switching or erratic winds require special safety considerations. **Check for snags** – Check all snags in the immediate area for soundness. A gust of wind may cause snags to fall at any time, as may the vibration of a tree fall. If it is safe to do so, begin by felling any snag in the cutting area that poses a threat. **Swamp out the base** – Clear small trees, brush, and debris from the base of the tree. Remove all material that could cause you to trip or lose your balance. Also remove material that will interfere with the saw, wedges, and axe. Look for small trees and brush that could accidentally stub the guide bar. Be careful not to fatigue yourself with unnecessary swamping. Remove only what is needed to work safely around the base of the tree.	Slide 4C-27 Slide 4C-28

OUTLINE	AIDS & CUES
Many fatalities have occurred because the sawyer did not move away far enough from the stump to avoid being struck or pinned.	
Assess the tree's lean and the soundness of the holding wood – Most trees have two natural leans, the predominant head lean and the secondary side lean. The leaning weight of the tree will be a combination of these two leans. Both must be considered when determining the desired felling direction.	Slide 4C-29 (video)
The degree and direction of these two leans is relative to your target. If you change your target, the degree and direction of the relative leans will change. Advanced cutting skills and decent hinge wood are needed to take a tree very far away from its natural combined lean.	
The desired felling direction can usually be chosen within 45 degrees of the combined lean, provided there is enough sound holding (hinge) wood to work with, especially in the corners of the undercut.	
Evaluate the tree's lean. With a plumb bob or axe, project a vertical line up from the center of the tree's base and determine whether the tree's top lies to the right or left of the projected line.	

OUTLINE	AIDS & CUES
Always establish the desired lay based on the predominate lean while considering overhead and ground hazards.	
A pistol-butt tree may appear to be leaning in one direction while most of the weight is actually in another direction.	
Look at the treetop from at least two different spots at right angles to each other. This will be done again in the sizeup process.	
The importance of the holding wood or hinge (the wood immediately behind the undercut), cannot be overemphasized.	Slide 4C-30
Assess the condition of the tree's holding wood by sounding it with an axe. A sound tree will produce a "solid" sound. A soft tree will produce a "soft" sound or "thunk." Look up for falling debris while doing so.	Slide 4C-31 Slide 4C-32 (video)
Boring to determine a tree's soundness is an important technique, but it must be done properly because it has the potential for kickback. Using the guide bar nose, bore into the area 90 degrees to the holding wood (hinge).	

OUTLINE	AIDS & CUES
Do not weaken the holding wood by boring into or across any of the holding wood. The color of the sawdust and ease with which the saw enters the wood will be your indication of the tree's soundness. Begin the boring cut with the power head lower than the nose of the bar to allow the attack portion of the bar nose to enter the wood first. Apply full throttle before the nose enters the wood. Once the nose of the saw is in the tree, orient the guide bar straight into the tree. Maintain full throttle throughout the boring cut while applying light forward pressure of the nose to push the saw into the tree. The left-hand thumb must be wrapped around the front handlebar. Check for frost cracks or other weak areas in the holding wood. The desired felling direction can be adjusted to eliminate weaknesses in the holding wood. The depth of the undercut can also be adjusted so that the holding area takes advantage of the soundest wood available.	

OUTLINE	AIDS & CUES
3. Escape Routes and Safe Zones • Walk out and thoroughly check the intended lay or bed where the tree is supposed to fall. Look for dead treetops, snags, and widow-makers that may cause throw-backs, allow the tree to roll, or result in another tree or limb becoming a hazard. Also look for any obstacles that could cause the tree to kick back over the stump or cause the butt to jump or pivot as the tree hits the ground. Look for any small trees or snags that could be thrown into your potential escape route. The escape route and alternate routes must be predetermined paths where the sawyer can escape once the tree is committed to fall. • Escape routes and safe zones should be at least 20 feet from the stump and 45 degrees to the sides and back from the direction of the fall. Sawyers must select and prepare the work area and clear escape routes and alternate routes before starting the first cut.	Slide 4C-33 through Slide 4C-35 Slide 4C-36 (video)

OUTLINE	AIDS & CUES
With the desired felling direction in mind, determine your escape route. Consider which side of the tree you will be making your final cut on and select a path that will take you at least 20 feet away from the stump when the tree begins to fall. • Do not choose a path directly behind the desired felling direction of the tree. It is best to prepare two escape routes in case you are forced to switch your location on the final cut. However, ensure you select one as the primary escape route, and do everything possible to work from that side of the tree. • Look for a large, solid tree or rock for protection. The tree or rock must be at least 20 feet away from the stump and not be directly behind it. Make sure that debris that could trip you is cleared from the escape route. Practice the escape. • Using the observations you made walking out the lay and during the other parts of the sizeup, reexamine your situational awareness. Your escape route, which side you work on, desired lay, and	

OUTLINE		AIDS & CUES
	whether it is even safe to fell the tree may change based on your observations. Be sure that your chosen route and side you work on will provide the highest level of safety before you begin to cut.	
4.	Felling Plan Based on what you learn from your sizeup, you will need to determine your felling plan. This plan should include the following: • Risk analysis – Scene safety. – Tree characteristics. • Key locations – Side of the tree you will be working on. – Exactly where each cut will be made. – Depth of cuts. – Angles of cuts. – Cuts in relation to each other.	Slide 4C-37 IR 4C-1 SR 4C-1, Student Workbook, page 4C.33

OUTLINE	AIDS & CUES
• Primary escape route – How it relates to the cuts you will be making. – Ensure you are not exiting behind the tree or crossing behind it. – Plan on exiting at close to a 45-degree angle when possible. • Secondary escape route (do not use unless there is imminent danger to the primary escape route). • Equipment check – Everything ready at hand. – Wedges where you can reach them without looking down. – Axe nearby. – Enough fuel in the saw for the entire job including unforeseen problems. • Wedging plan – Properly plan your working side of the tree so you don't have to swing offhanded.	

OUTLINE	AIDS & CUES
• Cutting area control – Final control check for safety of entire cutting area. Is there anyone or anything else that could possibly be affected by your cutting? It is imperative to develop a sound felling plan before any cuts are made in the tree. This plan is critical to ensure the work can be done safely. If the work cannot be done safely, do not start cutting the tree.	
B. Establishing Cutting Area Control The use of spotters while felling trees continues to be controversial; this can change depending on which agency you work for. This practice is unsafe for two primary reasons: • Possible temporary distraction of the lookout (wasps, fire runs, aerial activity) could leave the sawyer vulnerable at a critical moment. • Relying on a lookout's warning often leaves the sawyer inattentive to their own safety.	Slide 4C-38

OUTLINE	AIDS & CUES
Even as the lookout observes a hazard to the sawyer, there is no effective method to deliver a warning to the sawyer to escape in sufficient time. Once the sawyer is committed to the back cut, their total attention must focus on safely completing the cut, and they cannot be distracted by lookouts or concerns over their location. Often you may hear an argument that it's okay for a lookout to drive a wedge for a fatigued or fatiguing sawyer. WRONG! The chain saw should be out of the fatigued sawyer's hands long before then. Check to be sure the cutting area is clear of people. If a swamper or felling boss is present, they must remain no less than 2½ tree lengths away from the tree to be felled. Brief the swamper to assist with cutting area control to prevent other workers from entering the felling area. The swamper may be a lookout for the sawyer during undercut only.	
Play the Keeping Your Distance video.	Slide 4C-39 (video)
Play the condensed Sim Limb video.	Slide 4C-40 (video)
Optional Exercise: If time allows, do the exercise described in the full Sim Limb video in Appendix E – Advanced Chain Saw Tasks and Techniques.	Slide 4C-41 Slide 4C-42

OUTLINE	AIDS & CUES
C. Making the Undercut (Overview) This section covers the general mechanics of how undercuts work and how these mechanics apply to all types of undercuts.	Slide 4C-43 Slide 4C-44
There is a variety of undercut and back cut methods. Each method is specific to a particular cutting situation or felling technique, and all methods are not approved by all agencies. You should have an awareness of these methods and their appropriate applications.	Slide 4C-45 through Slide 4C-50
DO <u>NOT</u> GO INTO DETAIL NOW! **Conventional, open face notch, and other tree felling techniques will be discussed in detail later in this chapter. This section is only a basic introduction to the concepts that are common to all tree felling.** **The instructions on how to construct specific types of undercuts will be covered in later sections. This section applies to all types of undercuts.**	
It takes three cuts to fell a tree. The first two cuts form the "undercut" and the third cut is the "back cut." The correct relationship of these cuts results in safe and effective tree felling.	Slide 4C-51
There are multiple terms used interchangeably around the country to describe the undercut: "face," "face cut," "undercut," and "notch." The preferred term is undercut, which we use in the	Slide 4C-52

OUTLINE	AIDS & CUES
Instructor Guide and the Student Workbook. Some of the other terms may be used in the videos. The holding wood is also called the “hinge” or “hinge wood.” It is important to understand that safe tree felling is essentially creating a hinge (the uncut wood between the undercut and the back cut). Before discussing the felling procedure, we will analyze the mechanics of the felling cuts. The undercutting and back cutting processes will create the hinge that will control the direction and fall of the tree. • First, the undercut allows the tree to fall in the chosen path (lay) by removing the tree’s support in the direction of the undercut. • Second, the undercut enables control because the hinge determines the direction the tree will fall, unless the hinge wood breaks (snaps). The undercut consists of two cuts: a gunning cut (also called “horizontal cut”) and a matching cut (also called “sloping cut”). Observe overhead hazards, and look up often when making the undercut.	Slide 4C-53

OUTLINE	AIDS & CUES
You should be standing all the way up, with the saw comfortably held at waist level. If slope or other factors prevent you from standing up, you should be down on one knee.	
The tree is faced in the general direction of the tree's predominate lean. Ideally, the undercut is made in the same direction as the tree's lean, but because of obstacles, overhead hazards, unavailability of openings, or location of escape routes, the desired felling direction may be to one side or the other of the lean.	
Normally, the desired direction is less than 45 degrees from the lean for trees without brittle hinge wood and less than 15 percent for snags.	
If the tree has thick bark, it should be removed from an area on both sides of the tree along the plane of the gunning cut. The bark can be removed with a felling axe or a chain saw. Use caution in case the axe glances off the bole or the saw kicks back.	Slide 4C-54
If there is any danger from above, such as loose bark, widow-makers, or when cutting snags, the cutting should be done while standing so the sawyer can watch the top of the tree and escape more quickly.	

OUTLINE	AIDS & CUES
The specific direction of the undercut is determined by "gunning" the saw. This involves choosing a target parallel to the desired lay of the tree and using the gunning sights (marks) on the saw to accurately aim the direction of the fall. This target is not the desired lay, it is parallel to the lay and the same distance away from the desired lay as the gunning sights are away from the bark. These gunning sights are only accurate if you position yourself so that you can look directly down the length of the gunning sight, similar to aiming a rifle. A specific target should be used and memorized because you may use it again later for your back cut. Generally, the gunning cut is made to a depth that is $^1/_4$ to $^1/_3$ of the tree's diameter. Short snags sometimes require an undercut deeper than $^1/_3$ of the tree's diameter to offset the tree's balance. Trees with a heavy lean may not allow the sawyer to make the gunning cut as deep as $^1/_3$ of the tree's diameter without pinching the guide bar. The second part of the undercut is the matching cut. This cut allows a wedge to be removed, creating a space where the base of the tree can settle when the back cut is done.	Slide 4C-55 (animation)

OUTLINE	AIDS & CUES
When a back cut is added to the undercut, a hinge is created. Directional control is maintained as long as the hinge is intact. If an undercut is shallow, it will close sooner, breaking the hinge wood. If an undercut is larger, directional control is maintained longer. Remember, it is important that the face does not close until the tree is fully committed to the planned direction of the fall. The corners where the gunning cut and the matching cut meet should not overlap. This overlap is known as a Dutchman. If a Dutchman exists, it closes before the rest of the undercut. This can have a variety of undesirable consequences: • The tree could go off course. • The tree could split vertically (barber chair). • The hinge wood could break off unevenly. • Felling control is often lost when the Dutchman closes. A weak tree might snap off somewhere along the bole or at the top.	Slide 4C-56 Slide 4C-57

OUTLINE	AIDS & CUES
Describe the types of safety and felling problems the Dutchman creates, and the importance of ensuring the gunning cut and matching cut do not overlap.	
D. Making the Back Cut With Wedging	Slide 4C-58
1. Back cut mechanics The third cut needed to fell a tree is the back cut. The relationship of this cut to the face is important for proper tree positioning and the sawyer's safety.	
IMPORTANT NOTE: Always give a warning shout before starting the back cut.	Slide 4C-59 (video)
2. Wedging	
Felling wedges are used to create lift, helping tip the tree in a desired direction or prevent it from setting back by closing on the kerf. Keep at least three wedges and an axe readily accessible while making the back cut. The wedges should be accessible from a standing position by using only one hand, to avoid taking your attention away from the top of the tree.	Slide 4C-60

OUTLINE	AIDS & CUES
Keep the axe within arm's reach. The size of the wedge depends on the tree's diameter. For example, 10- to 12-inch wedges should be used on a 24-inch tree, and 4- to 6-inch wedges are more appropriate for a 10-inch tree. Remove thick bark at the back cut's kerf where wedges will be placed. If the bark is left in place, it can compress, lessening the lifting power of the wedges, or make the wedges harder to drive. Using two side-by-side wedges in the back of the tree is recommended for a number of reasons: It distributes lifting load and support across a wider area, it facilitates easier wedging by having the ability to alternate hits, and it leaves one wedge in the tree if the other gets knocked out. Ensure there is a viable platform before starting the felling procedure. Rotten wood will compress too easily, allowing the tree to sit back, creating a hazardous situation. Avoid creating a rocking action while pounding wedges. Pay attention to the top of the tree, and drive the wedges in a manner that prevents momentum and shock that can break the top out.	

OUTLINE		AIDS & CUES
	Wedges may be stacked if more lift is needed. When stacking wedges, crossing the wedges allows them to get locked more effectively. Rifled wedges are not recommended for stacking. Avoid wedging too close to the back of your hinge wood. Exerting force here can break the hinge wood in some situations, causing the tree to topple over uncontrollably.	
E.	Exiting Safely	Slide 4C-61
	It is recommended to have your hand immediately behind your chain brake while making your back cut, so you don't have to shift hand position. As soon as the tree starts committing, let off your throttle, and set the chain brake as soon as the chain stops spinning. This usually happens while you are taking your first few steps.	
	Practice being able to set the chain brake without having to look or reach for it. You should be able to use a quick flick of the wrist to engage the chain brake without having to let go of the front handlebar. Keep your eye on the top of the tree. Do not hesitate at the stump; take a few quick steps down your escape route with a quick glance over your shoulder to ensure the tree is committed and that nothing is coming back at you. Then exit the entire length of	Slide 4C-62

OUTLINE	AIDS & CUES
your escape route. If the saw becomes stuck, leave it. If carrying the saw prevents you from escaping quickly enough, drop the saw! If the felled tree strikes other trees, they may still be moving after the tree has fallen. Watch for flying limbs and tops. Remain in your safe zone until it is safe to approach the stump, watching for overhead hazards. Yell "all clear" when overhead hazards are no longer present.	
II. TREE FELLING TECHNIQUES AND PROCEDURES This section presents the most common tree felling techniques, along with step-by-step procedures for each technique.	Slide 4C-63
Choose either conventional or open face notch as the primary felling technique you wish to concentrate on for proficiency, but also cover other techniques for awareness.	Slide 4C-64
Terms that are used interchangeably throughout the country in reference to the undercut are "gunning cut" and "horizontal cut" (for one part of the undercut) and "matching cut" and "sloping cut" (for the other part of the undercut).	

OUTLINE	AIDS & CUES
A. Conventional (primarily used in the western part of the United States) The conventional technique is the most commonly used felling technique in the fire service today, predominantly used with the larger trees and softer wood that is encountered in the western U.S. This felling technique entails starting with a gunning cut (horizontal cut) that is ¼ to $^1/_3$ the depth of the tree diameter. The matching cut (sloping cut) is made from above at a 45-degree angle to the gunning cut.	Slide 4C-65
1. The undercut With a conventional undercut, the first cut should be the gunning cut. This is a gunning cut made at a comfortable working height that allows one to stand fully upright. The matching cut is above the gunning cut. These two cuts combine at a depth ¼ to $^1/_3$ of the tree's diameter. The back cut is also horizontal, above the gunning cut to allow for stump shot. The gunning and back cut should allow for hinge wood that is the thickness of about 10 percent of the tree's diameter.	Slide 4C-66 (video)

OUTLINE	AIDS & CUES

The best way to envision these cuts is by picturing a rectangle that extends through the tree. The bottom corner is the back of the face's horizontal cut. The opposite upper corner will be the back of the back cut.

The height of the rectangle is referred to as the stump shot. It is an anti-kickback device to prevent the tree from kicking back over the stump if it hits another tree during its fall. This is especially important when felling trees through standing timber.

The width of the rectangle is the holding wood. As the back cut is made, the sawyer must be careful not to cut this wood. Maintaining the holding wood is the key to safe and effective felling.

After selecting the desired felling direction, estimate $^{1}/_{3}$ the tree's diameter, and mark the hinge wood rectangle in the tree. If the tree has thick bark, remove it from an area on both sides of the tree along the plane of the gunning cut.

Make a level, horizontal cut just deep enough to support the weight of the saw. This cut should be at an angle about 45 degrees from the desired lay to prevent cutting in too deep on your offside.

OUTLINE	AIDS & CUES
Cut in on your onside until the bottom of your bar lines up with the front of your hinge wood. Set the saw's dogs at the bottom corner of the hinge rectangle, and begin the horizontal cut. Now continue to cut, using the dogs as a pivot point until your gunning sights line up with your target. The gunning cut is a level cut. This cut is made at a height comfortable for the sawyer, usually at standing waist height. The gunning cut dictates the direction of fall if the relationships of the three cuts are maintained. **If there is any danger from above, such as snags, the cutting should be done while standing so the sawyer can watch the top and escape more quickly.** The matching (sloping) cut needs to be angled so that when the face closes, the tree is fully committed to the planned direction of the fall. As the face closes, the hinge (holding wood) breaks. If this happens and the tree is still standing straight, the tree could fall away from the predetermined lay.	

OUTLINE	AIDS & CUES
As a general rule, make the matching cut at a 45-degree angle. Remember, it is important that the face does not close until the tree is fully committed to the planned direction of the fall. Start the cut above the top corner of the hinge on the face side, and draw the saw down to the corner of the gunning cut. Allow the chain to stop, leave the bar in place in the cut, pull the saw back, and sharply force the dogs into the trunk. This will maintain the angle of the matching cut across the face of the tree. It is difficult to make the matching cut and the gunning cut meet correctly on the opposite side of the tree. This is because the point of intersection is not immediately visible to the sawyer. After making a short matching cut, leave the saw running in the cut. Engage the chain brake. Go around to the offside of the tree and see if the guide bar is in the correct plane to intersect the back of the gunning cut. Keep your hands away from the throttle trigger. If the gunning cut cannot be easily seen, insert a clean stick in the offside gunning cut as a reference marker.	

OUTLINE	AIDS & CUES
Look down through the top of the bar to determine if the bar and stick are properly aligned at the 45-degree angle. If they are not, estimate the correct angle and adjust the bar angle to achieve the correct matching cut. Practicing on high stumps will help you become skilled at lining up these cuts. If the matching cut comes in short of a perfect corner, pivot the saw up, and, while leaving it in the original 45-degree-angled kerf, retilt it at a shallower angle in order to meet your corner. If the matching cut appears to be coming out slightly too high, there is no need to restart your cut; simply cut until you are in line with the vertical grain of the hinge wood and knock out the undercut with the felling axe. As long as this vertical plane hasn't been broken, the tree will follow the direction at the bottom corner of the hinge.	

OUTLINE	AIDS & CUES
2. The hinge The hinge (holding wood) is the wood immediately behind the undercut (notch). The gunning (horizontal) and matching (sloping) cuts must not overlap each other. If they do, the undercut must be cleaned up so no Dutchman is present. The corners are the holding wood at the ends of the undercut. The gunning and matching cuts must not overlap in this portion of the undercut, creating a Dutchman. Care must be taken not to cut the undercut too deeply while cleaning up. This reduces the amount of room available for wedges in the back cut. If cleaning up the matching cut will create an undercut that is too deep, stop the matching cut directly above the end of the gunning cut. The undercut needs to be cleaned out. Any remaining wood will cause the face to close prematurely and the holding wood will be broken behind the closure.	

OUTLINE		AIDS & CUES
	Once the undercut has been cleaned, recheck the felling direction. Place the dogs back in the holes left while making the gunning cut, and check the gunning sights or place an axe head into the face and look down the handle. The gunning sights can be used in reverse to help determine the guide bar position. The undercut should be perpendicular to the desired felling direction. If the tree is not aimed in the direction that you want it to fall, extend the gunning cut and the matching cut as needed, maintaining a single plane for each of the two cuts.	
3.	Back cut and wedging If your saw has a full-wrap front handlebar, the back cut can be made from either side of the tree; however, you should try to make the back cut from the same side as you did your undercut. This side should be the safest side to work from. It is called "onside." Your saw should be shut down after completing your undercut. Remove at least one ear plug and give two clear warning shouts, saying that you are starting your back cut, and calling out the direction your tree should	Slide 4C-67 (video)

OUTLINE	AIDS & CUES
fall. Also point in the direction of your fall with an open hand. This shout should be extremely loud and clear, i.e., "Back cut! Tree coming down towards the road! Tree coming down towards the road!" Listen for a response before starting your saw. Identify the appropriate amount of stump shot and holding wood before you start cutting. Many people find it helpful to envision a rectangle of wood that will be left as the hinge. It is recommended that newer fallers remove the bark down to the cambium layer on both sides of the tree where the hinge wood is to better distinguish the location of the hinge and the quality of the hinge wood. Many people find it beneficial to make marks in the tree where the hinge will be. To start the back cut, stand at the side of the tree with the power head adjacent to the undercut; the power head will actually be in front of the hinge with the bar behind the hinge. Hold the bar level, towards the back of the tree, parallel with the gunning cut but above it to allow for stump shot.	

OUTLINE	AIDS & CUES
Using the bottom of the bar, make a very small cut into the bark on the side of the tree. Cut in just enough to allow the saw's weight to be held by the kerf you made. Ensure the bar is level in both directions before continuing with your back cut. Once the bar is level, cut in on your onside only until the bottom of the bar reaches the back part of your holding wood. Now, set your dogs in the side of the tree; this will prevent you from cutting too deep on your onside. Without pausing, you can continue to cut your way into the back of the tree, making the saw pivot off of the dogs without pushing too hard. As you cut in deep enough to allow a safety wedge to be placed, stop cutting and insert a wedge. If a tree has an obvious strong forward lean, a safety wedge is not mandatory; in fact, pausing to insert a wedge may be dangerous.	

OUTLINE	AIDS & CUES
On trees without strong forward leans, continue to cut after your wedge is set, making sure to not cut into your hinge wood on your offside; pause occasionally to tap your wedge in. It is recommended that you stop cutting and visually check how much wood you have left on your offside; you can do this by setting your chain brake, leaving the saw dogged into the tree, and going around the back of the tree to visually check. A proficient faller will learn how to use and trust their gunning sights to line up their back cut. Sometimes the tree has enough forward lean to fall over, and sometimes you need to wedge; either way, stop cutting when you reach the back of your hinge. A common mistake for new cutters is to continue to cut into their hinge wood on a tree that needs to be wedged over.	
B. Humboldt The Humboldt felling technique is often used to fell larger trees in the western U.S. in order to facilitate easy removal of the larger undercut material.	Slide 4C-68 (video)

OUTLINE	AIDS & CUES
This felling technique is similar to the conventional technique in that it also has a horizontal gunning cut to a depth of ¼ to $^1/_3$ of the tree's diameter. The matching cut, however, is a sloping cut below the gunning cut at about a 45-degree angle.	
C. Open Face Notch	Slide 4C-69 (video)
The open face notch is the most commonly used felling technique for eastern hardwoods.	
1. Undercut (face cut)	
Start by creating a sloping gunning cut by holding level at breast height perpendicular to the desired felling direction. Tilt the bar so that it is approximately pitched at 70 to 90 degrees from horizontal. Use the gunning sights on the top and side of the saw to align with your desired lay.	
As you cut down, manage which end of the bar cuts more, so that a level, sloped gunning cut results. The depth of this cut should be ¼ to $^1/_3$ of the tree's diameter.	
Take caution to avoid cutting down too far on your gunning cut without double checking your gunning sights. The final height of the gunning cut should be at a comfortable cutting height.	

OUTLINE	AIDS & CUES
Remove the bar, and cut in from the front of the tree to make your second (matching) cut. This cut can be horizontal or sloping upwards. 2. Hinge The result of the undercut (the gunning cut plus the matching cut) should be a 70- to 90-degree opening. This large opening allows directional control of the hinge wood until the tree hits the ground, because the hinge doesn't get snapped (break) when the face closes. Clean out any resulting Dutchmen. Hinge wood should be 5 to 10 percent of the tree's diameter. 3. Back cut Initiate the back cut by making a shallow cut that is level with the apex of the notch you created. Cut in only far enough to allow the kerf to hold up the weight of the saw. Continue to cut by drawing the bar back to the back of the hinge wood. Now set the dogs; this will provide a pivot point and ensure your onside hinge is not cut unintentionally. Continue to cut in while pivoting off the dogs until there is enough room to place a safety wedge.	

OUTLINE		AIDS & CUES
	Insert a wedge, continue to cut in, and seat the wedge farther in as you continue the back cut. Stop cutting when the gunning sight lines up with the target, or if the tree starts to fall. Take care not to cut off the holding wood; once the safety wedge is placed, you can check the offside holding wood.	
D.	Bird's Mouth The bird's mouth felling technique uses a combination of sloping cuts to create an opening greater than 90 degrees. This technique allows further movement of the tree trunk before the holding wood is snapped due to a closed face. This allows directional control to be maintained longer.	Slide 4C-70 (video)
E.	Directional Felling The directional felling technique uses a combination of an undercut, hinge, and a back cut to fell trees in a desired direction. If a tree does not have back lean, it can be directionally felled without wedging. Remember, it is the hinge wood that allows for directional control of the tree; if that wood snaps or is cut, control of the tree is lost.	Slide 4C-71 Slide 4C-72 Slide 4C-73

OUTLINE	AIDS & CUES

If taking a tree against its natural lean, wedging is often needed to help tip the tree over.

Even when using wedges, it is the undercut and hinge that will provide the directional control. The wedges will provide the lift needed to shift the center of mass of the tree so that it falls in the desired direction.

If wedging trees over to directionally fell them, the wedges should still be placed in the back of the tree to provide maximum lift.

The hinge should be of adequate strength to provide side-to-side control of the tree while you are working, or you shouldn't be felling the tree.

As the back cut is being made, wedges are inserted and seated as the bar cuts deeper. The wedges will prevent the tree from sitting back on the saw, allowing you to cut deep enough to establish your hinge.

During directional felling, cutting with the saw does not allow the tree to go over by itself; the wedges will tip the tree.

After the back cut is established and your hinge is created, remove your saw and place it out of harm's way. Now use the wedges to drive the tree over.

OUTLINE	AIDS & CUES

Be careful not to drive the wedges too hard. They may bounce out of the kerf and cause the hinge to break prematurely, or the pounding may set up a dynamic response in the tree, causing material to fall on the sawyer. Weak tops and limbs can be broken out if wedging is done incorrectly.

Remember, if there are too many overhead hazards, a tree should not be directionally felled if it needs a lot of wedging.

As you cut or drive wedges, continually look above for possible hazards, and periodically check the kerf for movement.

F. Directional Felling of Small Trees Using Wedges

To directionally fell small trees, wedges are still needed; however, the small diameters of the trees make it difficult to use wedges.

Two common methods that can enable the use of wedges to directionally fell small trees are the quarter cut/back cut and by making the back cut first. These cuts may be attempted after gaining experience with other cuts.

For more information on directional felling, go to optional Appendix E – Advanced Chain Saw Tasks and Techniques.

OUTLINE	AIDS & CUES
G. Felling Snags	Slide 4C-74 Slide 4C-75
Remember: **Stay within your skill level**. If a felling task exceeds your skill level or your "gut" is uncomfortable, refuse the felling assignment and request a qualified faller for the task.	
A snag is a standing dead tree or remaining portion of a tree. Snags may be either sound (recently dead or the integrity of the wood fibers is intact) or soft (the wood fibers have decayed and the snag is punky).	
As with felling every tree, shout a warning. Everyone in the area must be notified. Remember, a snag can fall in any direction at any time.	
Observe the top. Pay special attention to overhead hazards, branches, and the snag's top. Upper limbs may be weak and ready to come down at the least vibration.	Slide 4C-76
Never cut directly below a hazard. Look up while driving wedges. Do not attempt to wedge a snag when the platform is too rotten to allow lift.	
Swamp out the base. Carefully check the condition of the bark on the snag. Loose bark can come sliding down the side of the snag and present an extreme hazard to the sawyer.	

OUTLINE	AIDS & CUES
Standing back with room to escape, remove loose bark at the snag's base by prying it with an axe or a pole. Do not chop the bark, because this would set up vibration in the snag. Perform a sizeup. Check the condition of wood by boring into it with the bar nose. Maintain the integrity of the holding wood. When sounding with an axe, look up while striking the tree. Check for frost cracks and other splits in the holding wood. Determine two escape routes. Since the holding wood is rotten to some degree, you must establish two routes of escape. The gunning sights can be used in reverse to help determine the guide bar position. Select the appropriate lay. **Do not fell a snag against its lean.** Make the undercut and the back cut while standing upright. You are in a position where you can easily look up, and less of your body is exposed to falling debris. In addition, you are in a position that allows immediate escape. When you are making the undercut, be alert for the snag pinching the bar. Previous boring in the undercut area during sizeup should alert you to this possibility. Moving the bar back and forth will minimize the possibility of pinching.	

OUTLINE	AIDS & CUES
If the snag starts to sit on the bar, finish the undercut just to that depth. It is critical that the undercut has a wide opening and that it be cleaned out from corner to corner.	
A short snag, with few or no limbs to give it lean, may need a face up to one-half the snag's diameter to offset the balance.	Slide 4C-77 (video) Slide 4C-78 (video)
Always flag any tree too dangerous to fell.	Slide 4C-79
III. LEANERS AND HANGUPS	
A. Leaners	
Leaners do not need as deep an undercut; cutting too deep on a leaner can pinch your bar. Leaners are also more prone to barber chairing.	Slide 4C-80
Two methods for removing leaners are a boring back cut and a triangle cut. You should gain experience before attempting these cuts.	Slide 4C-81
For more information on removing leaners, go to the optional Appendix E - Advanced Chain Saw Tasks and Techniques.	
B. Hangups	
Hangups can either be present naturally or can be created when a faller drops a tree and the tree being felled "hangs up" and does not reach the ground.	

OUTLINE	AIDS & CUES
Hangups are one of the most difficult and dangerous felling operations you will face; they account for a high percentage of cutting injuries every year. If you hang up a tree while felling it, or come across a naturally created hangup or leaner, you now have a very complex situation involving both felling and bucking issues and concerns. Consult with a more experienced faller before you make any cuts. Follow these recommended steps: 1. Shut the saw off, and set it down. 2. Do a complete assessment of the new situation. Does the hung-up tree need to come down? What safety concerns remain if the hung-up tree is left as is? 3. Do you feel comfortable handling this situation? Don't let the size of the hung-up tree lull you into complacency. Hangups and small-diameter trees are responsible for a large percentage of injuries. 4. Hangups can be difficult to assess. Ask yourself, "Have I seen this or had experience with this before?" Ask for assistance if you don't feel comfortable with the situation.	Slide 4C-82

OUTLINE	AIDS & CUES

5. Are there safer means, other than hand felling, available to deal with this new felling problem? Consider alternatives such as winch and cable, mechanical harvester, dozer, skidder, or blasting.

6. Can a no-work zone be identified and flagged to prevent unnecessary exposure and risk, while still allowing the work to be accomplished?

Discuss with the class different ways of taking down hangups. Emphasize the following bullet points.

Points to emphasize for taking down hangups:

- The angle of the hung-up tree, can dictate which method should be used to take it down.
- If the cut is made too high, the butt end can swing away from you, causing the top to come back at you.
- The quality of wood in the hung-up tree will dictate if it is safe enough to take down.
- When chunking down, it is critical to choose the correct angle so the tree goes in the correct direction.

OUTLINE	AIDS & CUES
• Purposely do not line up the kerf on the release cut during chunking to reduce the chance of catching the nose of your saw.	
Methods for mitigating hangups (for experienced fallers):	Slide 4C-83
• Chunking down • Accordion • P-cord • Explosives • Driving trees over with other trees • Rigging • Equipment	
For more information on mitigating hangups, go to the optional Appendix E – Advanced Chain Saw Tasks and Techniques.	
IV. STUMP ANALYSIS AND LOW STUMPING	Slide 4C-84
A. Stump Analysis	
Before cutting off the stump, take a moment to analyze your work. The stump gives the best critique of the felling operation.	
Before approaching the stump, look in the tops of the surrounding trees for new overhead hazards.	
Discuss with the students what is wrong with the pictures: gunning cut and back cut not level, hinge not even, root-pull at corner, stump shot uneven and short.	Slide 4C-85

OUTLINE	AIDS & CUES
Take time to analyze the felling operation: • Is the hinge even across the face of the tree? • How much holding wood (hinge) is left on each corner? Is the stump shot sufficient? • Were the cuts level? • Check the stump height and look for stump or root-pull and Dutchman cuts. Did the tree fall to the desired lay? How far from the center of the predetermined lay is the top?	
B. How to Low Stump When low stumping, the weight of the stump can damage your bar. A common method to prevent this is to use a single wedge to lift the stump as you are cutting. However, this method requires all the weight of the stump to be on your bar as you finish the cut. An alternative method is to use twigs and a wedge, which will allow the stump to rock and lift away from your saw as you finish the cut. The twigs should be slightly thicker than your kerf, placed past the halfway point of your cut to facilitate the kerf to open via the stump's weight. A wedge can be used initially to help insert the twigs.	Slide 4C-86 Slide 4C-87 (video)

OUTLINE	AIDS & CUES
Even if you are not going to cut your stump off, ensure any spikes left over are trimmed off to prevent potential future injuries.	
Review Unit 4C objectives. **Present Unit 4C quiz.**	Slide 4C-88 Slide 4C-89

FELLING PLAN OUTLINE

☐ **Risk analysis**

- ☐ Scene safety.
- ☐ Tree characteristics.

☐ **Key locations**

- ☐ Side of the tree you will be working on.
- ☐ Exactly where each cut will be made.
- ☐ Depth of cuts.
- ☐ Angles of cuts.
- ☐ Cuts in relation to each other.

☐ **Primary escape route**

- ☐ How it relates to the cuts you will be making.
- ☐ Ensure you are not exiting behind the tree or crossing behind it.
- ☐ Plan on exiting at close to a 45-degree angle when possible.

☐ **Equipment check**

- ☐ Everything ready at hand.
- ☐ Wedges where you can reach them without looking down.
- ☐ Axe nearby.
- ☐ Enough fuel in the saw for the entire job including unforeseen problems.

☐ **Wedging plan**

- ☐ Properly plan your working side of the tree so you don't have to swing off-handed.

☐ **Cutting area control**

- ☐ Final control check for safety of entire cutting area. Is there anyone or anything else that could possibly be affected by your cutting?

UNIT OVERVIEW

Course Wildland Fire Chain Saws, S-212

Unit 4D – Chain Saw Tasks and Techniques: Felling **(**Field Proficiency)

Time 30 minutes classroom and 5-8 hours field, depending on class size

Objective

Demonstrate competence in safely felling trees in the least complex situations.

Strategy

Students will practice the felling techniques they learned in the classroom and gain proficiency in operating a chain saw through field exercises.

Instructional Method(s)

- Short introductory lecture followed by field exercise

Instructional Aids

□ Computer with LCD projector, presentation software, and screen

Exercise

- Field proficiency exercise

Required Personal Protective Equipment (PPE) for Each Instructor and Student

See the Instructor Reference (IR 4D-1) at the end of this unit.

Tools Required for Each Student Group

See the Instructor Reference (IR 4D-1) at the end of this unit.

Evaluation Method(s)

- Instructors and field evaluators will evaluate individual students using the Chain Saw Operator Field Evaluation Form (in Appendix C).

Outline

I. Field Exercise Responsibilities

II. Conducting Field Training for Sawyers

III. Skill Demonstrations

Aids and Cues Codes

The codes in the Aids and Cues column are defined as follows:

IG – Instructor Guide
SW – Student Workbook
HO – Handout
IR – Instructor Reference
SR – Student Reference
Slide – PowerPoint

UNIT PRESENTATION

Course Wildland Fire Chain Saws, S-212

Unit 4D – Chain Saw Tasks and Techniques: Felling (Field Proficiency)

OUTLINE	AIDS & CUES
Present Unit 4D title slide.	Slide 4D-1
Present Unit 4D objective.	Slide 4D-2
The instructor (and field evaluators) will work with the students in a field environment using the techniques and procedures taught in the classroom.	
Students must first practice their cuts before using them on standing trees.	
Students will perform felling under the guidance of a qualified instructor and will be evaluated on their skill level.	
I. FIELD EXERCISE RESPONSIBILITIES	Slide 4D-3
A. Instructor Responsibilities	
The instructor (and field evaluators) must take an active role in training and evaluating the students.	
Instructors need to demonstrate the skills properly and work with the students to ensure that they gain the skills needed to operate chain saws safely.	

OUTLINE	AIDS & CUES
The instructor needs to make honest, constructive assessments when evaluating students, and document the assessments on the Chain Saw Operator Field Evaluation Form (in Appendix C). The instructor is responsible for evaluating whether the students have the skills to do the work safely. If the students don't have those skills, the instructor should document the additional training needed on their Chain Saw Operator Field Evaluation Form. Students must understand that further training may be required before sawing in different regions because of the differences in tree species, wood properties, tree sizes, and topography. During the field training sessions, safety should be the number one concern of instructors and students. Something can always go wrong during skill-related training. Instructors must do a thorough job of planning before beginning the field training sessions. • The instructor must ensure cutting area control for their own group and between groups. Be aware of the activities taking place in all cutting areas. Ensure that students follow correct safety procedures at all times.	

OUTLINE	AIDS & CUES
• Demonstrate and have the students apply the procedural approach to felling. Instructors should verbalize correct procedures before each tree is cut. The instructor must also discuss the safety procedures to follow in case of an accident. • A fully qualified instructor must be at the base of the tree within a few feet of the sawyer to monitor the process and prevent accidents. • When selecting a cutting area, determine the needs of the students. Work with local resource staff to locate a site that is suitable, has good access, and does not have safety hazards that cannot be mitigated. Obtain all proper clearances through the environmental analysis process. • Recommended ratio for the field exercise is no more than three students per instructor or field evaluator. • A JHA/RA that includes first-aid procedures and emergency evacuation plans will be prepared in advance and discussed with the students. Use the hosting agency's safety and health handbook and safety information in this unit to help develop these plans.	

OUTLINE	AIDS & CUES
• Conduct a tailgate safety session that includes all safety aspects of the field proficiency exercises, first-aid procedures, and emergency evacuation plans. • Ensure that all students have all safety items listed on the Chain Saw Operator Field Evaluation Form.	
B. Student Responsibilities • Students must have all PPE and tools for the field exercise as listed in IR 4D-1 and SR 4D-1. • Take responsibility for your safety and for the safety of all other participants. • Demonstrate cutting area control. • Ask for clarification on task completion. • Review the JHA/RA. • Participate in tailgate safety sessions. • Correctly use all required PPE. • Verbalize correct procedures before each tree is cut.	Slide 4D-4 through Slide 4D-9 IR 4D-1 SR 4D-1, Student Workbook, page 4D.7
Use the Chain Saw Operator Field Evaluation Form in Appendix C to document the students' abilities while performing these exercises.	

OUTLINE	AIDS & CUES

II. CONDUCTING FIELD TRAINING FOR SAWYERS

A. Secure the Felling Area

Many safety issues can be addressed by establishing a secure felling area. A secure felling area must be identified and managed.

- The area needs to be no less than 2½ times the height of the tree being felled, in all directions.
- On hillsides with steep slopes, the entire downhill side will be included in the secure area.
- No one shall be allowed in the secured felling area without authorization by the sawyer and instructor.
- A safety zone will be established outside the secure area. Everyone must remain there until all felling is completed and the sawyer has shouted ALL CLEAR.
- Whenever practical, the safety zone should be opposite the direction of the planned fall, and no less than 2½ times the tree's height from the tree being felled.

OUTLINE	AIDS & CUES
• One person shall be responsible for maintaining reliable communications with the sawyer and with people in the safety zone to ensure that no one enters the secured felling area. • A road or trail guard will be set up on all roads and trails entering and leaving the secured felling area. This will prevent members of the public or other employees from entering the area. Effective communication must exist between the guards and the sawyer. • Before leaving the secured felling area, the sawyer needs to ensure that no hazards remain (such as hangups, unstable logs, or other dangers). To protect the lives of employees, contractors, and the public, the sawyer must adhere to these standards. Supervisors and all employees must understand and follow these standards. B. Monitor the Cutting Procedures The instructor will monitor cutting procedures and take corrective actions or discontinue cutting if problems develop.	

OUTLINE	AIDS & CUES
Common problems include: • Inaccurate gunning (sighting) that may cause the tree to fall in the wrong direction or get hung up in another tree. • Too deep an undercut that may cause a tree to go over backwards or fall before the undercut is complete. • A potential barber chair. Recognize this situation before it occurs. • Accidental or intentional removal of all or part of the holding wood. • Any changes in wind or lean. Is the student aware of these changes? • Wedging too late or other improper wedging. • Incorrect thumb placement on the front handlebar.	
III. SKILL DEMONSTRATIONS	Slide 4D-10 (video)
A. Practice Stumps Making accurate undercuts is often difficult for new cutters and can be dangerous. Practice stumps can be used by beginning students to become proficient at making these cuts before working on a standing	

OUTLINE	AIDS & CUES
tree. A variety of practice stump methods exist, some of these are: • High stumps • Stand-up stumps	
The following tasks will be accomplished with a gasoline-powered chain saw equipped with a 16- to 24-inch straight guide bar and all required PPE. Student performance will be documented on the Chain Saw Operator Field Evaluation Form.	Slide 4D-11
B. Tree Felling	Slide 4D-12
The students shall: • Demonstrate the ability to determine and prepare a safe felling area, and maintain cutting area control. • Demonstrate the ability to correctly identify and mitigate overhead and ground hazards associated with tree felling. • Given a sound tree or snag, up to 20 inches in diameter at breast height (dbh) in a closed stand of timber on slopes less than 30 percent, the student will correctly size up the tree, prepare the intended lay and escape routes, and fell the tree(s) within 15 feet of the center of the intended lay measured at the top of the tree.	

OUTLINE	AIDS & CUES
• Demonstrate the ability to complete a stump analysis of the student's evaluation tree(s). When students have successfully completed training, the instructor will award a course training certificate. The employing agency of the student will establish Incident Qualifications (Red Card). Instructors shall include any restrictions or endorsements on the Chain Saw Operator Field Evaluation Form for the Red Card. The course coordinator will forward copies of the Chain Saw Operator Field Evaluation Forms completed for each student to each student's supervisor.	
Discuss the Chain Saw Operator Field Evaluation Form (on slide and found in Appendix C – Student Assessment).	Slide 4D-13
Review Unit 4D objective. **Review course objectives.**	Slide 4D-14 Slide 4D-15 Slide 4D-16

ITEMS NEEDED FOR UNIT 4D

Required PPE for each instructor and student:

- ☐ Approved hardhat (full brim or cap style).
- ☐ Wrap-around eye protection (safety glasses or shield).
- ☐ Hearing protection (ear plugs or muffs, approved for 85 decibels and higher).
- ☐ Gloves (slip- and cut-resistant and appropriate for the weather conditions).
- ☐ Long-sleeved shirt appropriate for the weather conditions.
- ☐ Pants (loose fitting and long enough to cover boot tops). Do not cut (stag) fire pants to shorten them.
- ☐ Heavy-duty, 8-inch-high, laced, water-resistant leather boots (cut-resistant, with ankle support and non-slip soles, appropriate for the weather conditions).
- ☐ Approved chain saw chaps (chaps should overlap boot tops by at least 2 inches).
- ☐ Appropriate first-aid kit. Employees should carry their own surgical gloves.
- ☐ Require students to wear standard fireline clothing and PPE.

Tools required for each student group:

- ☐ Single-bit axe with a 3- to 5-pound head and sheath (straight handle is recommended).
- ☐ Plastic wedges (appropriate length to match the tree diameters).
- ☐ Approved gas and oil containers.
- ☐ Approved belt fire extinguisher (if required).
- ☐ Whistle or other signaling device.
- ☐ Appropriate tool kit with spare parts.
- ☐ Tool belt.
- ☐ Wedge pouch.
- ☐ Chain saw in proper working order.
- ☐ Appropriate communication device (radio or cell phone).
- ☐ Extra saw chain (correctly filed and maintained).
- ☐ For the field exercise, students must have a copy of the course JHA listing all emergency evacuation and communication procedures.