Controlled Ecological Burn Crew Training

Oakland Township Parks and Recreation

Contents

Big thanks to the folks at Ann Arbor Natural Areas Preservation: David Bourneman, Mike Hahn, Tina Stephens, and many other who put together training materials for their prescribed fire program over the years. They generously let us use their materials for our training program.

Oakland Township Parks and Recreation
Natural Areas Stewardship Program
248-651-7810 ext. 401
bvanderweide@oaklandtownship.org

Agenda

9:00 Sign In

- Handouts: *Burn Training Folder and your choice of Oakland Township Parks & Recreation info*
- Slideshow: *Photos of Prescribed Burns from various Oakland Township parks*

9:10 Introductions

- Overview of the day: schedule, refreshments, breaks, restrooms, questions
  - *Power Point Notes: Introductions, Why, When p. 3*

9:15 Terms

- *Power Point Notes p. 3*

9:35 Burn Day Process

- *Sample Burn Prescription: Bear Creek Nature Park p.6*
- *Map: Bear Creek Nature Park p. 10*
- *Ignition Techniques p.11*
- *Ignition Techniques Diagram p.12*

10:20 Smoke Scale

- *Controlled Burn Smoke Scale (adapted from AA NAP) p. 13*

10:30 Crew Assignments and Equipment Used

- *Crew Assignments and Responsibilities p. 14*
- *Crew Assignments and Equipment p.15*
- *Equipment Diagrams p.16*

10:50 Hands on Time!

- *Hand tools (use and safety)*
- *Water backpacks (fitting, filling, using)*
- *Intro to burn gear*
- *Radio protocol and maps*

12:00 Lunch

12:30 Safety Concerns and Equipment/ Safe Guards

- *Personal Protective Equipment p.17*
- *Hand Tool Safety p.18*
- *Hazards Encountered in Controlled Burning p.19*
- *Personal Safety Concerns p. 20*
- *Smoke Concerns from Wildland Fires p. 21*
- *Watch Out Situation p. 23*
- *HazCom p.24*
- *Medical Form and Waiver (front pocket of folder)*

1:00 Fire Behavior & Suppression

1:20 Break

- Get ready and go outside

1:30 Demonstration/Mock Burn (outside, weather permitting)

- *Controlled Burn Briefing Checklist p.24*
- *Final Logistics p.25*

2:00 Questions and Discussion

- Back inside– Make sure to get your Medical form and waiver in!

Power Point Presentation Notes

Introduction

Goals and questions

Why?
To reintroduce fire into fire-adapted ecosystems to stimulate native plant and animal populations and give them a competitive advantage over invasive, fire-sensitive species.

When?
Weather permitting, weekdays (late morning through afternoon), end of February through end of May and mid-October through mid-December

Terms to Know

- Prescribed Burn vs. Controlled Burn
- Burn Prescription (Burn Plan)
- Burn Unit
- Burn Break
- Black Line
- "Slop over" or "jump the break"
- Fuel (vegetation that carries the fire)
- Torch mix
- Line of Fire or Fire Line
- Back Burn/Fire or Backing Burn/Fire
- Flanking Fire
- Head Burn or Head Fire
- Ring Fire
- Interior Ignition /Burn out the Interior
- "Burn around"

- Strip Head Fires or Strip Fires
- Spot Fire
- Mop-up
- Chimney Tree
- RH
- FFM

Pre-Burn Day

- Burn Prescription/Plan
- Permits
- Crew Training
- Public Notification
- Equipment Preparation
- Pre-fire Photo Monitoring

Almost Burn Day

Wait for Acceptable Weather Conditions

You can monitor this too: www.weather.gov and http://glffc.utah.edu/cgi-bin/glffc/gl.cgi

Burn Day

- Notice to Volunteers: email
- Final Public Notice
- Site Preparation
- Final Site-specific Crew Training and Assignments
- Briefing
- Final Equipment Preparation and Check

Post Burn

- Debrief
- Photo point
- Seeding
- Babysit smolders and recheck next day
- Take down signs
- Contact Fire Departments
- Note equipment repairs
- Pack up trailer
- Drain water tank/hose/pump
- Recharge radios
- Monitor Fire Effects

Smoke Scale

- Level 0 – Not detectable
- Level 1 – Light
- Level 2 – Moderate
- Level 3 – Heavy
- Level 4 – Dense

Crew Assignments and Responsibilities

- Burn Boss
- Igniters
- Waterpack/Sprayers
- Weather Monitor
- Smoke Monitor
- Public Relations
- Water Tank Pump Monitor

Crew Equipment

- Drip torch
- Backpack sprayer
- Cappaert elbow
- Flapper
- Council rake
- McLeod rake
- Pulaski

Safety Concerns and Safe Guards

- Personal Protective Equipment
- Safety Concerns
- Smoke Concerns

Fire Behavior and Suppression

- The Fire Triangle
- Influences on Fire Behavior
- Communication and Response

Example Burn Prescription

1. LOCATION

Park:	Bear Creek Nature Park
Nearest cross streets:	Snell Rd. and Orion Rd.
Truck Access:	Park entrance at 740 W. Snell Rd
Map Location: Lat/Long (T/R/S):	lat 42.734, long -83.154 (T11, R04, Sec 27)
Nearest Supplemental Water:	Ponds in park, spigot at Watershed Ridge Park maint building
Ownership:	Charter Township of Oakland
Size of burn unit:	10 acres

2. ON-SITE CONTACT

2-Way Radio:	Channel 1
Ben Cell Phone:	248-XXX-XXXX
Crew Cell Phone:	248-XXX-XXXX

3. SOURCES OF EMERGENCY ASSISTANCE: Call 911

Fire:	Oakland Township Fire Department: 248-XXX-XXXX
Law Enforcement:	Oakland County Sheriff: 248-XXX-XXXX
Medical:	Crittenton Hospital, 1101 W. University Dr., Rochester, MI 48307

Nearest Landline Phone to Unit: Park neighbors, OTPR office at 4480 Orion Rd

4. PERMITS AND OFFICIAL NOTIFICATIONS

Complete?	Name	Contact	Phone Number
	Review Burn Rx with OTFD	Paul Strelchuk	
	Oakland Township Fire Department	Paul Strelchuk	248-XXX-XXXX (cell) 586-XXX-XXXX (Station #2)
	Oakland County Sheriff Dispatch		248-XXX-XXXX
	Oakland County Sheriff substation	Sgt. Tony Spencer	248-XXX-XXXX
	Oakland Township Main Office		248-XXX-XXXX
	Oakland Township Parks & Rec	Office, Doug Caruso	248-651-7810 248-XXX-XXXX (Doug cell)
	Community within 0.25 miles	Newsletter, mailing	

5. NEIGHBOR NOTIFICATIONS

Name	Address	Phone
Ernest Hemingway (asthma concerns)	1111 Bear Creek Court	123-456-7890
Cam Mannino (park steward)		c 248-XXX-XXXX
Baldwin Elementary School	4325 Bannister Road	248-XXX-XXXX
Heartfelt Impressions ELC	4461 Collins Road	248-XXX-XXXX

6. UNIT DESCRIPTION

Vegetation Types	Fuel Models	% of Unit Area	% Slope	Aspect
Moderate load grass	GR6	100	0-5	slightly N

Fire Unit Narrative Description (include description of surrounding fuels):
The burn unit includes the prairie vegetation at the interpretive node and surrounding fields, which contain a mix of cool and warm-season grass fuels 1-3' tall.

Maps Attached:

_____ Burn Unit Map with fire breaks, ignition patterns, back-up water, reference points, hazards, fire-sensitive areas and nearby roads

_____ Smoke Screening Map

7. PRESCRIBED BURN JUSTIFICATION

Burn Unit Management Goal(s): Establish native prairie and oak savanna vegetation.

Specific Burn Objectives: Reduce the abundance of non-native cool season grasses, stimulate native plants in prairie and savanna plantings

History of Previous Burns or Fires: None for parking lot island or native plant gardens. Interpretive node burned on April 6, 2008 and May 19, 2014..
Projected Date or Time of Year of Burn: Late April to mid-May
Precautions needed for sensitive plants/animals: Not aware of any

8. FUEL AND WEATHER PRESCRIPTION

Parameters	MIN	MAX	Preferred (if applicable)
Wind Direction (degrees)	0	360	any
Ground-level wind speed	5	15	8-12
20 ft wind speed	7	30	12
Transport wind speed	9	20	12
Air Temperature (°F)	40	80	60-70
Relative Humidity (%)	15	55	30
Days since rain	1	14	
1-hour fuel moisture (%)	5	10	7-8
10-hour fuel moisture (%)	NA	NA	
100-hour fuel moisture (%)	NA	NA	
Live Fuel Moisture (%)	75	250	150
Atmospheric mixing height	1700	Unlimited	4500

9. PREDICTED FIRE BEHAVIOR From BEHAVE: use inputs from above; include predictions for fuels surrounding burn unit. Use as a guide to potential range of behavior from a free-burning fire, and for contingency planning.

Fuel Model	GR6	#	#
Max Headfire Flame Length (ft)	**11.2 ft**		
Min. Headfire Flame Length	**5.4 ft**		
Max. Headfire Rate of Spread	**93.6 ch/hr**		
Min. Headfire Rate of Spread	**19.6 ch/hr**		
Max. Backfire Flame Length	**1.4 ft**		
Min. Backfire Flame Length	**1.4 ft**		
Max. Backfire Rate of Spread	**1.1 ch/hr**		
Min. Backfire Rate of Spread	**1.1 ch/hr**		
Max. Scorch Height	**47**		

10. FIRE BEHAVIOR NARRATIVE

Describe *desired* fire behavior. How will you manipulate fire behavior to meet management and control objectives?)
Slow backing fire and flanking with 1-4 foot flames will be used to ensure complete removal of thatch and good kill of non-native cool season grasses. If somewhat difficult to sustain burning fuels, head fires and strip head fires with 2-8 foot flames will be used after black on downwind side and flanks are adequate.

11. SMOKE MANAGEMENT PLAN

Online simple smoke screening tool: shrmc.ggy.uga.edu/maps/screen.html
List downwind/ down-drainage smoke sensitive areas (give direction and distance):

Name	Direction	Distance (miles)
Oakland Township Hall	W	0.25 miles
Baldwin Elementary School	W	0.45 miles
Heartfelt Impressions Early Learning Center	W	0.35 miles
Private residences	All directions	0.2 miles
Snell Road	S	0.05 miles
Orion Road	S	0.4 miles
Collins Road	W	0.4 miles
Gunn Road	N	0.4 miles

List other smoke sensitive areas:

Describe desirable smoke behavior and smoke management actions:

Quick smoke lift and dispersion. Burn when mixing height is at least 1700 feet and transport winds at least 9 mph. Do not begin burn after 4 pm to ensure smoke disperses before air begins to cool. Smoke Management Actions:

1) Conduct burn when atmospheric conditions allow for maximum lifting, mixing and transportation (mixing height at least 1700 feet and transport winds at least 9 mph)
2) Place two signs on Snell Road warning drivers of smoke from prescribed burns.
3) Create burn breaks around dead snags, chimney trees, stumps, logs, brush piles to prevent burning.
4) Attempt to have the burn and mop-up completed prior to rush hour traffic. Do not start burn after 4 pm.
5) Make sure nothing is left smoldering when we leave the site.
6) Schedule burn during weekdays when fewer people on-site or in nearby homes.

12. MINIMUM CREW SIZE (not counting burn leader)

Igniters (2)
Holding Crew (4)
PR/Smoke Monitors (1)
Describe crew organization: Burn leader will oversee the implementation of the bun plan and will participate in burning as necessary. Crew will be divided into two squads. Each squad will have igniters and holding. Igniter will be responsible for spreading fire under direction from the burn leader. Additional squad members will be responsible for holding, ensuring that fire is contained by burn breaks.

13. EQUIPMENT

Equipment Item	Number	Source
Truck with 130 gallon water tank	1	OTPRC
Gator with 25 gallon water tank	0	OTPRC
Tractor with 40 gallon water tank	0	OTPRC
5 gallon Backpack Pumps	4	OTPRC
Flapper	2	OTPRC
Council rake	2	OTPRC
Fire rake	2	OTPRC
Pulaski	0	OTPRC
Leaf blower	0	OTPRC
Chainsaw	1	OTPRC
Drip torches	4	OTPRC
Drip torch fuel	4 gal	OTPRC
Smoke caution signs	2	OTPRC
Kestrel weather unit	1	OTPRC
Fully charged portable radios	4	OTPRC
First Aid Kit	1	OTPRC
Drinking water	5 gal	OTPRC
Cell Phone	2	OTPRC
2-way radios	6	OTPRC

14. BURN DURATION

Perimeter burn break preparation: 1 hour
Interior burn break preparation: 0
Spreading fire: 1 hour
Mop up: 2 hours
Total Anticipated Duration: 3 hours

15. MANAGING THE BURN:

Firebreak preparations: Use existing trails when possible. When trails not available, mow 10 foot burn break and rake thatch if thick.

Fire sensitive areas: At interpretive node, benches, signage, and planted trees are in mowed area, but will need to be monitored. Blow or rake breaks around standing dead trees. Remove tires, batteries, and trash from site prior to burn

Fire behavior, smoke, and weather monitoring: The burn boss will monitor fire behavior and smoke. Crew members will take weather immediately before the burn (standing in fuels) and every hour afterwards if needed.

Public relations: One crew member will be designated to interact with the public and provide information about prescribed burning.

Crew Communication: Each crew member will have a mobile radio and will communicate with clear text. If any radios fail, that crew member will remain within line-of-sight of other crew members. Crews will be familiar with radio use before igniting the burn. A pre-burn briefing will be used to communicate the burn plan to all crew members. Reference points around the perimeter of the burn will be labeled for reference.

Firing techniques and ignition pattern: These burn units are centrally located in the park, so they can be burned from any wind direction. Ignition will start on the downwind side. A combination of several firing techniques will be used during the burn. To establish good black lines, backing and flanking fires will be used on the downwind side and flanks. Special care will need to be taken at the interpretive node to create good black line at the mowed fire break. No head fire ignition will commence until at least 20 feet of black is on the downwind side and flanks. As firing progresses, a black line will be maintained along the perimeter.

Holding: Crew members will follow behind igniters controlling fire on the perimeter. The holding crew will ensure fire is contained along perimeter before igniters advance. All spot fires outside the line will be immediately reported to the burn boss. Ignition will be stopped until spot fires are contained.

Contingencies (include safety zones, escape routes, secondary control lines, escape procedures):

Safety zones are located around the burn unit, including the gravel parking lot, mowed lawn, and the black. Escape routes will be the fire line. All locations of safety zones and escape routes will be identified to all personnel on the day of the burn.

All crew members will be instructed on the best way to control slop over or spot fires. The burn boss will be notified of any spots that occur. Any spots that occur will be aggressively attacked once crew safety is assessed. All ignition will stop until the burn boss has determined that ignition can continue. Surrounding roads, trails, and natural barriers will be used as secondary control lines. A truck with a 130 gallon tank and pump will be located at the burn unit for suppression support.

In the event of a spot fire, the holding crew will act as initial attack for the spot. If they feel they cannot handle the spot, they will request additional resources from the burn boss. If the spot cannot be contained by the burn crew, the burn will be declared a wildfire and additional suppression resources will be requested from the Oakland Township Fire Department.

Potential hazards to crew: Stumps, ruts, branches hidden in the grass, insects, poison ivy, smoke, heat from fire, working around trucks and equipment, and vegetation that may hinder visibility and mobility.

Mop up: The burn units must be completely out, with no smoking or smoldering material at the end of the day. Burn around interior logs and other large fuels to prevent lengthy mop-up.

Follow-up assignments: The burn boss will notify any contacts that wish to know that the burn has been completed. The burn boss will check the burn units the following day to make sure that they are completely out.

16. **DOCUMENTATION**

Photos of burn unit taken before and after burn? Yes/No

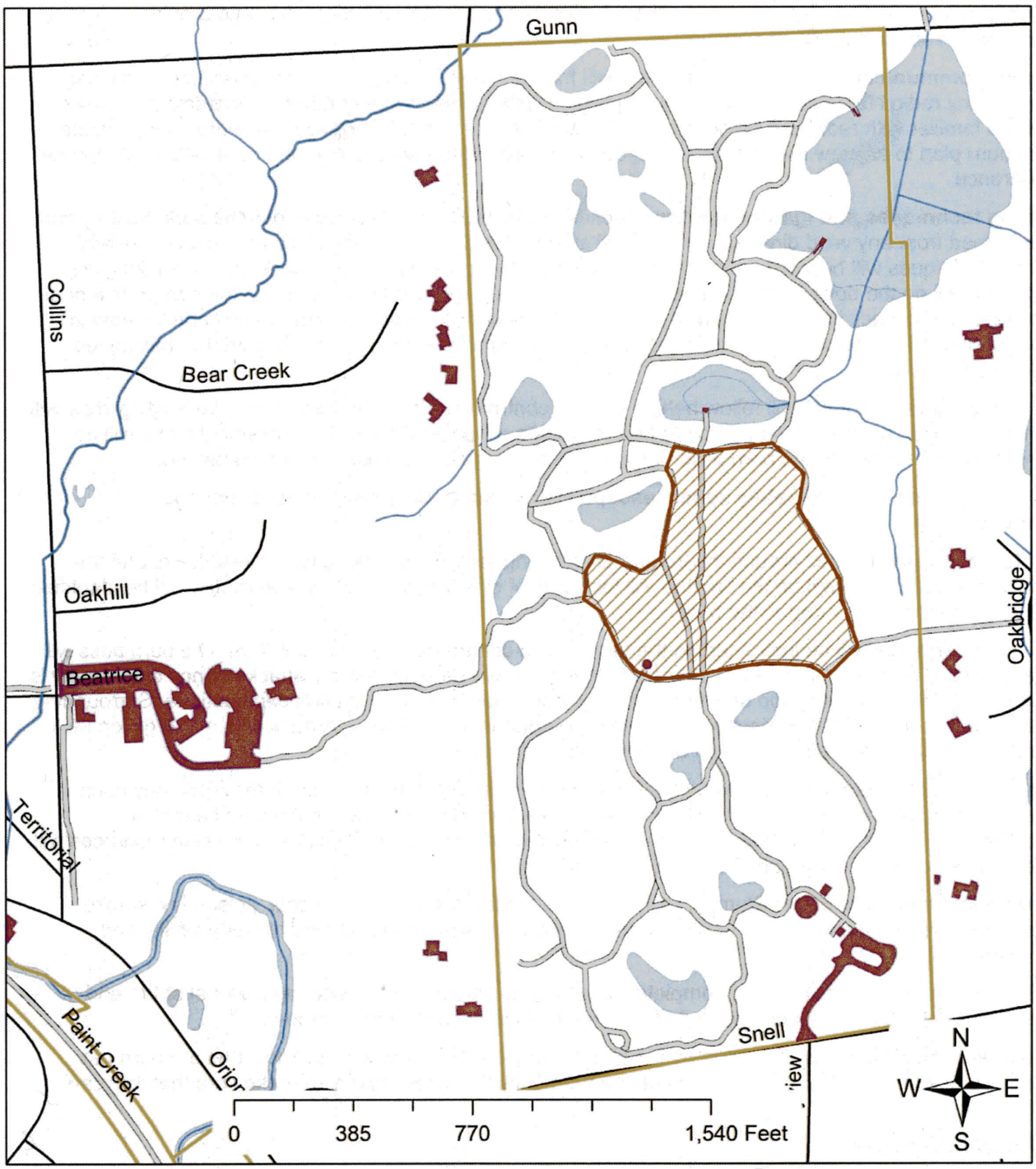
Post-Burn Evaluation

17. **SIGNATURE OF BURN LEADER**

_____ _____

Benjamin VanderWeide Date

Example Burn Unit Map



Legend

- Park Boundary
- Burn Unit
- Trails
- Streams and Rivers
- Lakes and Ponds
- Roads

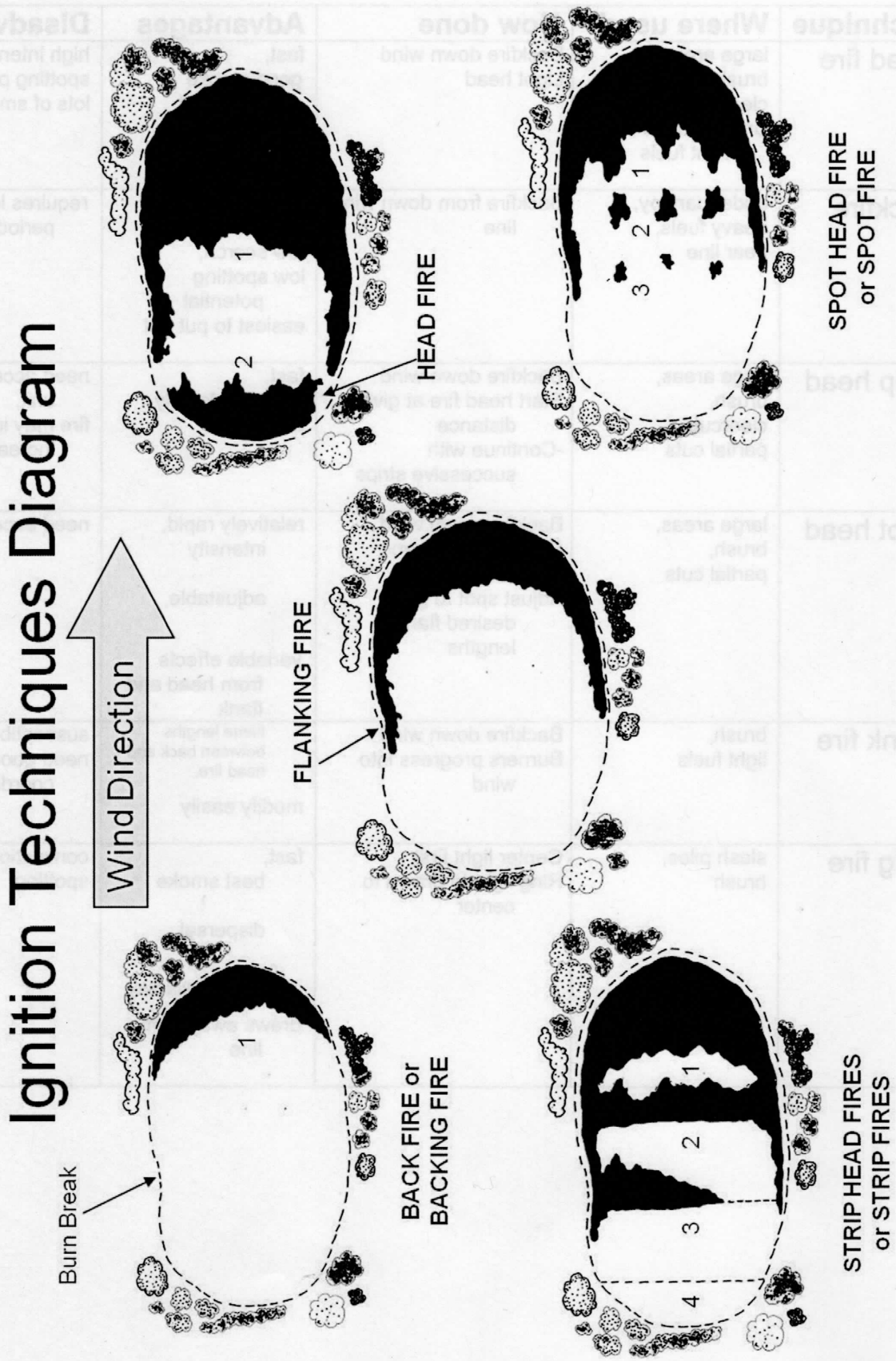
Bear Creek Nature Park
Rx Fire Crew Training
Sample Map
740 W. Snell Rd.
Rochester, MI 48306

Important Information:
In emergency call 911
Ben cell phone: 248-XXX-XXXX
Parks office: 248-651-7810
Fire Department Station #2: 586-XXX-XXXX
Hospital: Crittenton Hospital, 1101 W. University Dr.

Ignition Techniques

Technique	Where used	How done	Advantages	Disadvantages
Head fire	large areas, brush, clearcuts, under stands with light fuels	Backfire down wind Light head	fast, good smoke dispersal	high intensity, spotting potential, lots of smoke
Backfire	under canopy, heavy fuels, near line	Backfire from down wind line	slow, low intensity, low scorch, low spotting potential easiest to put out	requires long burn period
Strip head	large areas, brush, clearcuts, partial cuts	Backfire down wind Start head fire at given distance -Continue with successive strips	fast, flexible intensity adjustable	need access to the unit, fire may interact and increase intensity
Spot head	large areas, brush, partial cuts	Backfire down wind Start spot at given distance Adjust spot to give desired flame lengths	relatively rapid, intensity adjustable, variable effects from head and flank	need access to unit
Flank fire	brush, light fuels	Backfire down wind Burners progress into wind	flame lengths between back and head fire, modify easily	susceptible to wind, need good coordination
Ring fire	slash piles, brush	Center light first Ring light to drawn to center	fast, best smoke dispersal, very high intensity, draws away from line	convection currents, spotting

Ignition Techniques Diagram



Controlled Burn Smoke Scale

These readings only pertain to the site where you, the smoke monitor, are located. What is the smoke like there, where you are? IT SHOULD NOT BE USED TO EVALUATE SMOKE THAT YOU SEE FROM A DISTANCE.

Level	If you are along a road.	If you are in a residential area
0 - Not detectable	----	-----
1 - Light	Motorists can begin to see it in the roadway, or smell it, but it poses no safety hazard	Residents can begin to see or smell it, but it should pose no problem unless someone is highly sensitive.
2 - Moderate	There is definitely smoke in the roadway, but motorists should be able to see through it and continue safely.	Smoke is quite noticeable, like being next to a campfire. But most residents would not find this level of smoke irritating for a short period
3 - Heavy	Smoke is beginning to reduce visibility and create unsafe driving conditions (This will depend on traffic speed and volume).	Smoke is beginning to create uncomfortable conditions for people outside.
4 - Dense	Very unsafe - motorists cannot see to drive. Like driving in dense fog.	Smoke has created very uncomfortable conditions. It hurts to breathe.

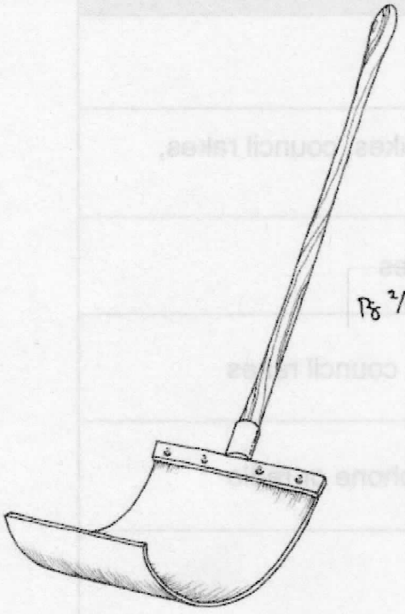
Burn Crew Assignment and Responsibilities

Position	Primary Responsibilities
Burn Boss (1 person)	**Oversees entire burn and directs specific crew actions** **Describes burn objectives – what should burn, and how it should burn** **Determines when and how to shift into suppression mode or shut down burn** Decides when to begin mop-up and when it is complete Communicates with burn crew, smoke spotters, weather monitor, and PR person
Crew Leader	**Oversees a specific task or small crew of people on the fire line** **Remains aware of conditions and actions of crew** **Communicates with burn boss to report progress and to relay instructions to team**
Igniter (1-5 people)	**Knows location of burn unit and breaks, and uses drip-torch to ignite appropriately** **Understands fire and smoke behavior and anticipates changes** **Stays aware of position of backpack sprayers and people inside burn unit**
Waterpack/Sprayer (2-10 people)	**Knows location of burn unit and breaks, and contains the fire within the burn unit** **Uses backpack sprayers or other methods to control or extinguish fire appropriately** **Understands fire and smoke behavior and anticipates changes** **Understands burn objectives – what should and should not be burning** Monitors and controls burn breaks and adjacent unburned fuels for accidental spot fires Monitors and controls potential hazards or mop-up issues (chimney trees, large fuels) Works in teams for safety and to rotate in and out of smoke: <u>1st BP</u> *Stays close to igniter to watch for unintended ignition *May work with the igniter to burn around logs, chimney trees, salamander habitat <u>2nd BP</u> *Hangs back to make sure burn breaks and hazards are secure before moving forward *Sets the line crew pace (the burn boss may not move it forward until breaks are secure) <u>3rd BP</u> * May be needed on larger burns or with more chimney trees or hazards
Weather Monitor (1 person)	Collects weather data: relative humidity, temperature, wind speed & direction Communicates with Burn Boss regularly – updating weather every hour Often serves as a PR person and/or smoke monitor
Smoke Monitor (1 person)	Understands smoke targets and Burn Boss threshold for reporting and action Observes smoke dispersal and reports it using the smoke scale to the Burn Boss Reports any problems immediately – requires constant vigilance Often serves as PR person
Public Relations (1 person, and all crew as appropriate)	Answers any questions or concerns the public might have Directs public to designated viewing areas where they will be safely out of the smoke Helps monitor smoke and/or weather if needed Has Prescribed Burn Fact Sheets and is able to direct the public to additional information, resources, or the Burn Boss as appropriate Helps sign-in volunteers, collect medical sheets and direct volunteers where to go
Water Tank Pump Operator (all crew as appropriate)	Must understand the water delivery system and ensure pump is operational prior to the burn, and assist with trouble-shooting during the burn Uses hose for mop-up, suppression and filling empty backpack sprayers

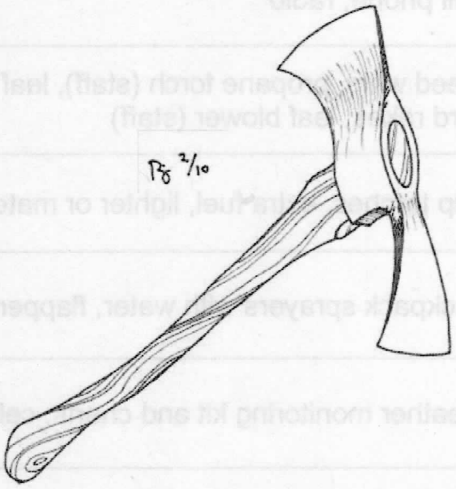
Crew Assignments and Equipment

Assignment	Equipment
Burn Boss	Cell phone, radio
Burn Break Makers	Weed whip, propane torch (staff), leaf rakes, council rakes, hard rakes, leaf blower (staff)
Igniters	Drip torches, extra fuel, lighter or matches
Backpack Sprayer/Holding	Backpack sprayers with water, flappers, council rakes
Weather Monitor	Weather monitoring kit and charts, cell phone or radio
Smoke Monitor/PR person	Public information handouts
Fire Effects Monitor	Documents fire activity and effectiveness
Water Tank Pump Operator	300-gallon water tank, pump, hose (usually a staff member who can drive a township truck)
Photographer	Camera (still or video
Mop-up Crew	Backpack sprayers, "Cappaert elbows," Council rakes, shovels, Pulaskis, Chainsaw (operated only by staff with proper PPE and training)
All	Walkie-talkies
Assignments made based on clothing, training, interest, needs, experience, and training	

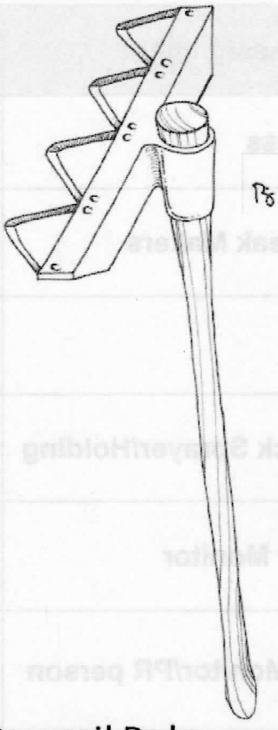
Burn Equipment



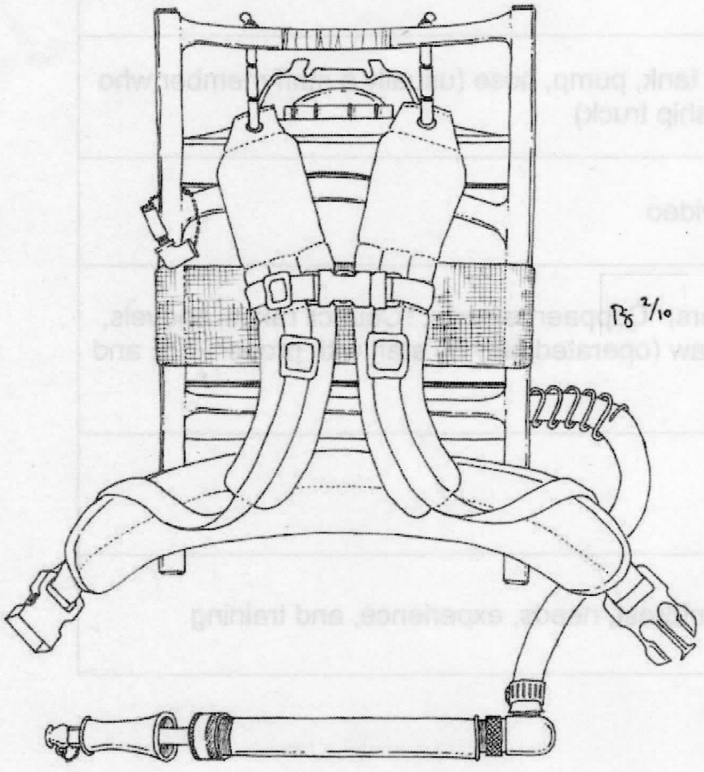
Flapper



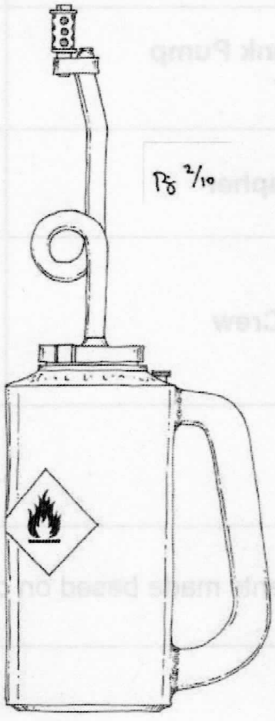
Pulaski



Council Rake

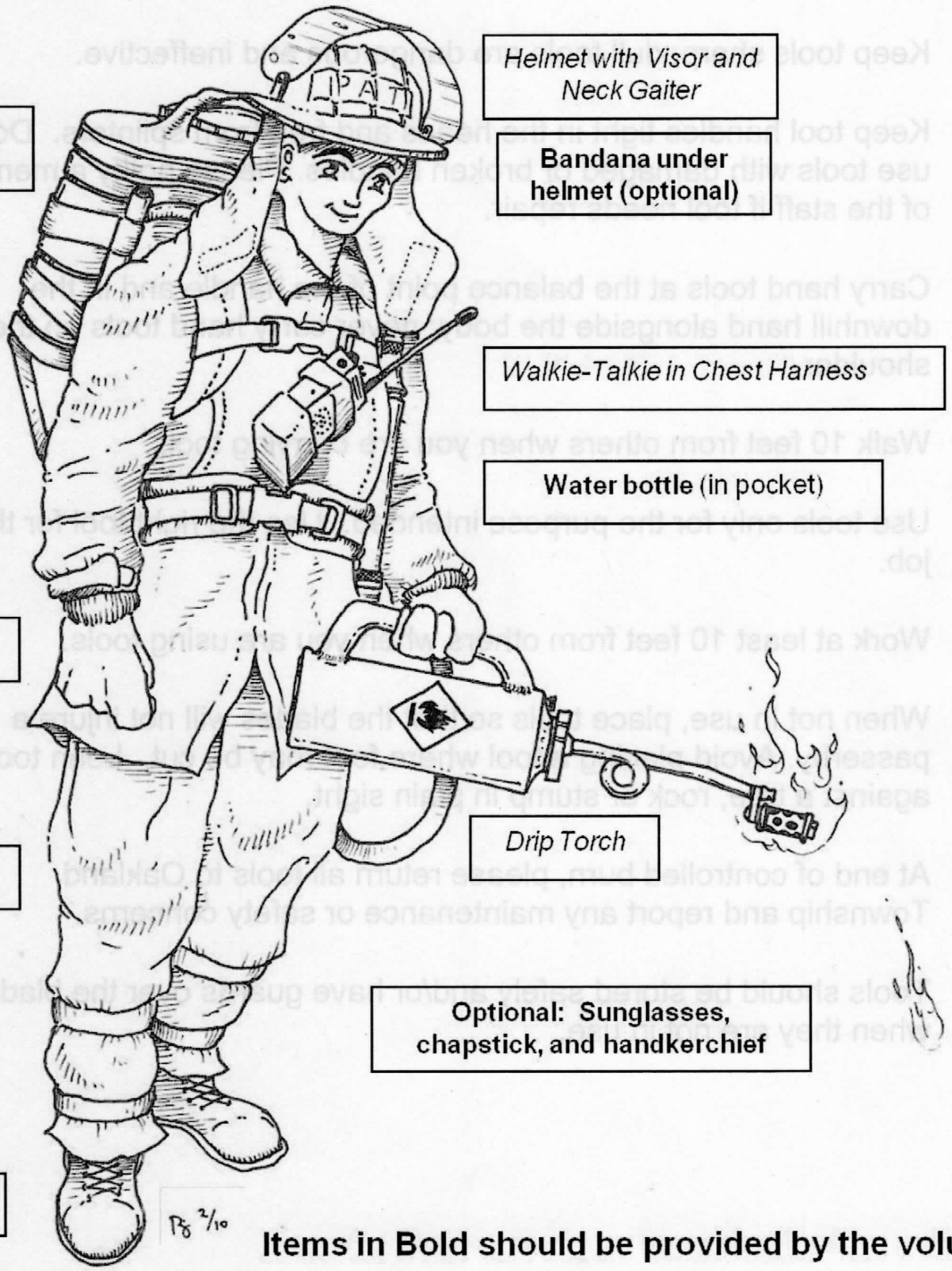


Backpack Sprayer



Drip Torch

PPE Diagram



Items in Bold should be provided by the volunteer

Items in italics are provided by OTPR

Hand Tool Safety

The following precautions should be observed by all burn crew members to ensure safe use of hand tools (e.g. axes, fire rakes, pick axes, Pulaskis, etc.):

- Keep tools sharp; dull tools are dangerous and ineffective.
- Keep tool handles tight in the heads and free from splinters. Do not use tools with damaged or broken handles. Please notify a member of the staff if tool needs repair.
- Carry hand tools at the balance point of the handle and in the downhill hand alongside the body: never carry hand tools on the shoulder.
- Walk 10 feet from others when you are carrying tools.
- Use tools only for the purpose intended. Use the right tool for the job.
- Work at least 10 feet from others when you are using tools.
- When not in use, place tools so that the blades will not injure a passerby. Avoid placing a tool where feet may be cut. Lean tools against a tree, rock or stump in plain sight.
- At end of controlled burn, please return all tools to Oakland Township and report any maintenance or safety concerns.
- Tools should be stored safely and/or have guards over the blades when they are not in use.

Hazards Encountered in Controlled Burning

The following list encompasses reasons why some prescribed burns create hazardous situations that cause the fire to escape from the containment area:

- **Overconfidence**: Prior to the burn, a careful evaluation of weather conditions, person power, equipment, and other factors should be made to determine whether the burn should be attempted or not.

- **Bad fire weather**: Careful attention should be directed to the weather conditions for the next 24 hours. If wind velocity, temperature, or relative humidity will exceed the desired limits, it may be advisable to postpone the burn until conditions are more suitable.

- **Inexperience**: Only experienced, trained people should be present to assist with firebreak location and construction, and the organization of the burn.

- **Equipment failure**: All equipment should be checked prior to the burn to make sure that it is working properly. Extra or backup pieces of equipment in case something fails need to be available. Two very critical items are water packs and drip torches.

- **Inadequate fire breaks**: Burn breaks need to be wide enough and void of grass, leaves, and wood to prevent the fire from crossing the line.

- **Peer pressure**: Some individuals may say, "We have traveled all this way to conduct this burn, so why don't we start the fire?" The individuals that are directing the burn should not be influenced by such reasons in the decision making of conducting a burn.

- **Small crew size**: Enough individuals should be present to adequately patrol the firebreaks as well as contain the fire.

- **An inadequate water or drip torch fuel supply**: Always include an extra supply of water for water packs. Always have an extra supply of drip torch fuel; not having enough may mean not being able to start a backfire to contain a runaway head fire;

- **Changing weather conditions**: Use weather radios to continually monitor the weather and therefore learn of wind changes or the possibility of precipitation. Wind shift changes should be reported immediately to the individuals that are directing the burn.

- **People who don't follow directions**: These individuals create problems by lighting the fire line too fast, or by failing to accomplish their assigned task. Notify individuals in charge.

Personal Safety Concerns

1. **Concern**: Ignition of clothing and hair due to fire/flames. Melting of clothing or burns due to excess heat. Hot drip torch tips and hot engine on water pump.

   Equipment/safe guards: Nomex (or fire retardant treated) coveralls, wearing wool or cotton – no synthetics. All leather boots and gloves. Nomex neck/ear shields and long sleeves and long pants. No jewelry, no loose hair.

2. **Concern**: smoke inhalation (carbon monoxide poisoning, asthmatic reaction, poison ivy), particulate matter.

   Equipment/safe guards: Stay out of the smoke! Wear goggles or visors. Avoid standing in smoke! What do you do if you find yourself engulfed in smoke?

3. **Concern**: Over-exertion, dehydration, sunburns.

   Equipment/safe guards: Take frequent breaks, trade roles, carry on your person – water bottles and chapstick, apply sunscreen.

4. **Concern**: Communication during the burn with others on the crew.

   Equipment/safe guards: Use radios, learn radio etiquette.

5. **Concern**: General field safety – bee/wasp stings, poison ivy, cut stumps, branches, thorns, traffic, trains etc….

   Equipment/safe guards: First Aid kit, protective clothing, alertness and communication, medical form

6. **Concern**: Sharp tools – pulaskis, pickax, council rakes.

   Equipment/safe guards: leather boots, hard hats with face shields. Only staff with safety-toed boots should be swinging pulaskis.

IN CASE OF AN EMERGENCY: Notify staff immediately! Cell phone and city radios are always present to call for help.

A Few Concerns about Smoke from Wildland Fires (Including Controlled Burns)

The following are the primary smoke products from wildland fires:

- Carbon Dioxide (CO2) 2000-3500 lbs produced per ton of fuel consumed
- Water Vapor (H2O) 500-1500 lbs/ton
- Carbon Monoxide (CO) 20-500 lbs/ton
- Particulate Matter (PM) 10-100 lbs/ton
- Hydrocarbons 4-40 lbs/ton
- Nitrogen oxides 1-9 lbs/ton

Section 109 of The Clean Air Act - requires EPA to create primary air quality standards to protect human health and secondary standards to protect human welfare and the environment.

- Primary air quality standards are designed to protect the most sensitive members of the public, including the very old, the very young, and people with heart and lung problems.
- These primary and secondary air quality standards are called the National Ambient Air Quality Standards (NAAQS) for certain pollutants, called criteria pollutants. These include ozone, nitrogen oxides, lead, sulfur oxides, carbon monoxide (CO), and particulate matter (PM). Of these, only the last two – CO and PM – are produced by wildland fires in significant concentrations. Of theses, PM is the pollutant of higher concern.
- PM is any solid or liquid particle less than 100 microns in diameter that is suspended in the atmosphere. (A micron = 1/25,000 of an inch).
- PM10 = PMs of 10 microns or smaller in size. Most monitoring/regulating emphasis has been on these in the past. There are currently no "non-attainment" areas for PM10 in Michigan.
- PM2.5 = PMs of 2.5 microns or smaller in size. (It takes 100,000 of these to equal the size of a particle of beach sand!) These will be the focus of future monitoring/regulating. Preliminary monitoring by the MDEQ suggests that much of the metropolitan Detroit area will be "non-attainment" when enforcement kicks in, in 2004.
- Most smoke particles from wildland fires are relatively small:
    - 10% by mass are greater than 10 microns in diameter (size of fly ash).
    - 20% by mass are between 2.5 and 10 microns in diameter (size of dust)
    - 70% by mass are smaller than 2.5 microns in diameter (size of pollen)

- How does your body protect itself from PMs?
    - Nose: hairs and mucous capture most PMs > 10 microns
    - Trachea: mucous and cilia capture many PMs > 5 microns

- But many particles < 5 microns can penetrate much deeper into the lungs. These fine particles are deposited in the alveoli where the body's defense mechanisms are ineffective in removing them.

- "On a smoggy day in a major metropolitan area, a single breath of air may contain millions of fine particles. Some 74 million Americans (28% of the population) are regularly exposed to harmful levels of particulate air pollution. In recent studies, exposure to fine particles – either alone or in combination with other air pollutants – has been linked with many health problems, including:
    - An estimated 40,000 Americans die prematurely each year from respiratory illness and heart attacks that are linked with particulate exposure, especially elderly people.
    - Children and adults experience aggravated asthma. Asthma in children increased 118% between 1980 and 1993, and it is currently the leading cause of child hospital admissions.
    - Children become ill more frequently and experience increased respiratory problems, including difficult and painful breathing.
    - Hospital admissions, emergency room visits and premature deaths increase among adults with heart disease, emphysema, chronic bronchitis, and other heart and lung diseases.
    - Fine particles showed consistent and statistically significant relationships to short-term mortality in six U.S. cities, while coarse particles showed no significant relationship to excess mortality in five of the six cities that were studied." (Smoke Management Guide for Prescribed and Wildland Fire, 2001 edition.)

OSHA has their own view of the hazards of smoke. They list the following 5 primary health hazards relative to human exposure to smoke from wildland fires:

1. Acrolein: an aldehyde with a piercing, choking odor. Humans are sensitive to this toxin at very low levels (odor threshold: 0.1 ppm). Causes eye and nose irritation, stinging, tearing, and vomiting.

2. Formaldehyde: similar effect on humans, but at higher levels (odor threshold: 1.0 ppm)

3. Respirable particles (<PM2.5 - already discussed)

4. Carbon Monoxide (CO) – Colorless, odorless gas. Causes acute effects ranging from diminished work capacity to nausea, headache, and loss of mental acuity. Most effects are easily reversible if victim gets fresh air. As a result of rapid dilution, CO from burns is not a concern for the general public, but it may be a concern for fire crew personnel.

5. Benzene – causes headaches, dizziness, nausea, and breathing difficulties. Comes from combustion of petroleum products (rather than biomass) – so likely only encountered if working close to drip torches, water pump, or leaf blowers.

Source: RX-410 Smoke Management Techniques Course, sponsored by National Wildfire Coordination Group, Feb. 10-14, 2003.

Watch Out Situations

1. **Rapidly changing weather conditions** (Such as wind shifts, change in fire speed, slop over)
   Response: Notify burn boss.

2. **Unclear or conflicting instructions**
   Response: Ask burn boss for clarification. Do not take any action if you are not absolutely clear on what to do.

3. **Not in contact with Burn Boss or others on fire**
   Response: Check your radio and make sure the volume is turned up and that it is on the proper channel. If your radio still isn't working, borrow one from another crew member and notify the burn boss.

4. **Insufficient burn breaks and/or frequent slop over**
   Response: Notify burn boss. Stop igniting and work on controlling slop over.

5. **Terrain or fuels make safe exit from fire difficult**
   Response: Notify burn boss before entering the area. Do not walk into any area where you feel unsafe.

6. **Burning upslope**
   Response: Fire moves quickly upslope, so always position yourself downhill of the fire. Ignite slowly to avoid having the fire go out of your control. Have plenty of water on hand.

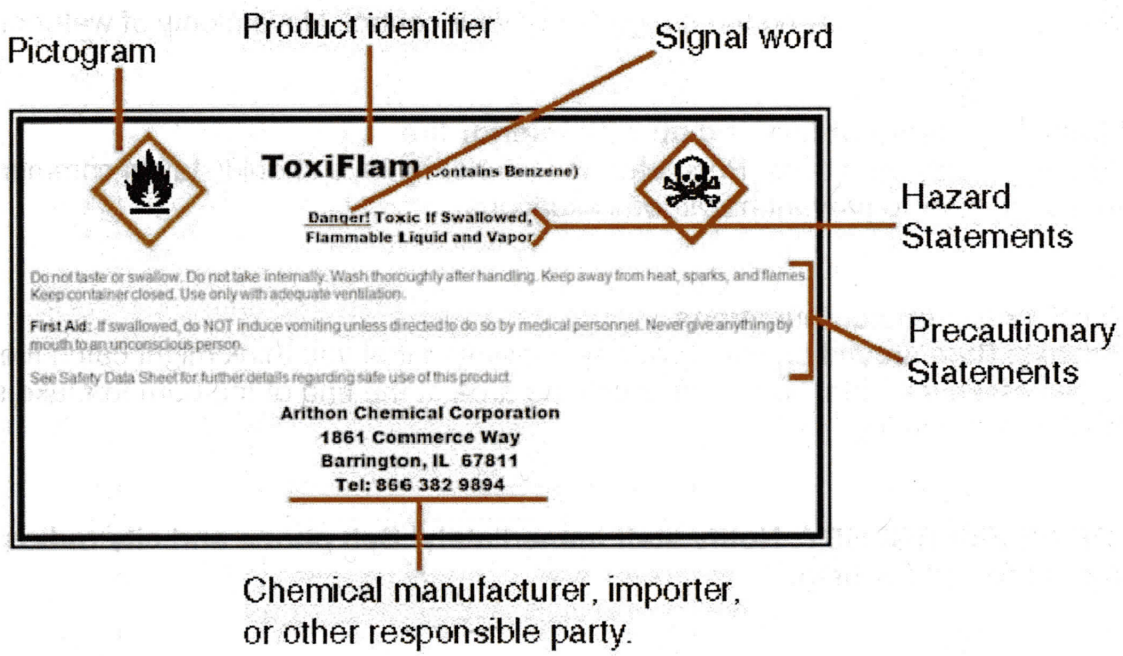
7. **Perimeter igniters not keeping up with interior fire**
   Response: Notify burn boss. Perimeter and interior igniters should stay in communication to move together to prevent hazardous situations.

8. **Potential mop-up complications**
   Response: Burn around or wet down any heavy fuel that you think might catch fire and smolder. Make a mental note to re-check the area at the end of the burn to make sure nothing is still burning.

IN CASE OF AN EMERGENCY: Notify staff immediately! Cell phone and city radios are always present to call for help.

HazCom: Pictogram and Label

Flame Over Circle	• Oxidizers	**Flame**	• Flammables • Self Reactives • Pyrophorics • Self-Heating • Emits Flammable Gas • Organic Peroxides	**Exploding Bomb**	• Explosives • Self Reactives • Organic Peroxides
Skull and Crossbones	• Acute toxicity (severe)	**Corrosion**	• Corrosives	**Gas Cylinder**	• Gases Under Pressure
Health Hazard	• Carcinogen • Respiratory Sensitizer • Reproductive Toxicity • Target Organ Toxicity • Mutagenicity • Aspiration Toxicity	**Environment**	• Environmental Toxicity	**Exclamation Mark**	• Irritant • Dermal Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract • Hazardous to Ozone Layer



Controlled Burn Briefing Checklist

BEFORE BRIEFING

_____ Required firebreaks complete and checked
_____ Required equipment is on site and functioning
_____ Official and neighbor notifications are complete
_____ Planned ignition and containment methods are appropriate
_____ Planned contingencies and mop-up are appropriate
_____ Weather and fuel conditions are within prescriptions
_____ Check previous year's burn plan and comments
_____ Review medical forms for entire crew
_____ Review roles needed for burn

CREW BRIEFING

_____ Introductions
_____ Tape first name to front and back of hard hat
_____ Who is new to the crew?
_____ Who needs to leave early and when?
_____ Volunteer sign-in and sign-out
_____ Any requests for positions/roles for burn?
_____ Check boots and clothing of each crew member
_____ Each crew member has a burn unit map, landmarks and cardinal directions discussed
_____ Map of surrounding area and roads to burn boss and smoke monitor
_____ Go through prescription/burn objectives, why we are burning this site
_____ Go through "day-of" burn conditions: anticipated fire/smoke behavior, fuel type, burn breaks (perimeter and interior hazards), site-specific burn conditions
_____ Discuss safety: hazards, dead ash, chimney trees, poison ivy
_____ Crew assignments/responsibilities
_____ Check your own equipment to make sure it is working properly
_____ Review expectations for mop up and how to properly use tools
_____ When to switch roles and with whom
_____ Review how to control slop-over
_____ Contingency plans, escape routes and safety zones
_____ Radio use and protocol (review backup plan for communications)
_____ Perform radio check
_____ Make sure PR person is clear on role
_____ Remind weather person to take readings in representative conditions (not parking lot, etc)
_____ Make sure appropriate people have truck keys
_____ Is everyone comfortable with assignment and clear on what is expected?
_____ Answer crew questions

DURING BURN

_____ Check in with smoke monitor and call Parks Office for smoke report if appropriate
_____ Take weather hourly
_____ Monitor crew safety

BEFORE LEAVING BURN UNIT

_____ Mop-up completed as described in prescription
_____ Next morning inspection arranged
_____ Post-burn pictures taken
_____ Notifications of completed burn (if required)

Final Logistics

_____ Final site check

_____ Make sure all pre-burn task have been accomplished

_____ On-site crew briefing and assignments

_____ Notification of emergency dispatch

_____ Test burn

_____ Ignition and execution of the burn plan

_____ Continual monitoring of fire and smoke

_____ Continual monitoring of weather

_____ Continual monitoring of crew safety

_____ Look for any potential problems

_____ Mop-up fire

_____ Gather equipment and signs

_____ Notify dispatch

_____ Post-burn debrief with crew

_____ Written burn analysis

_____ Post-burn photo monitoring