



# Oregon DEQ 2002 Residential Wood Combustion Emissions Inventory

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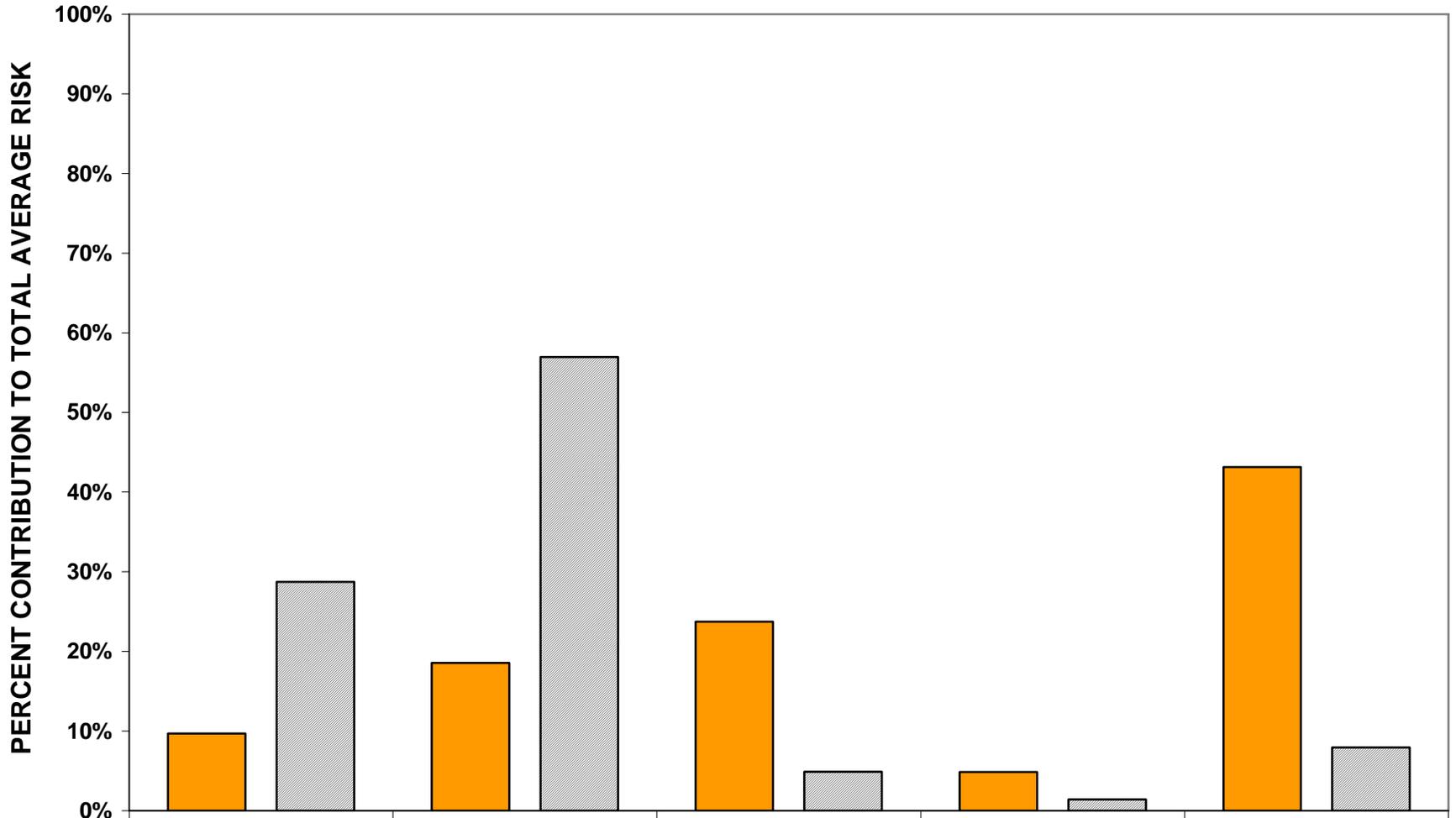


# Introduction



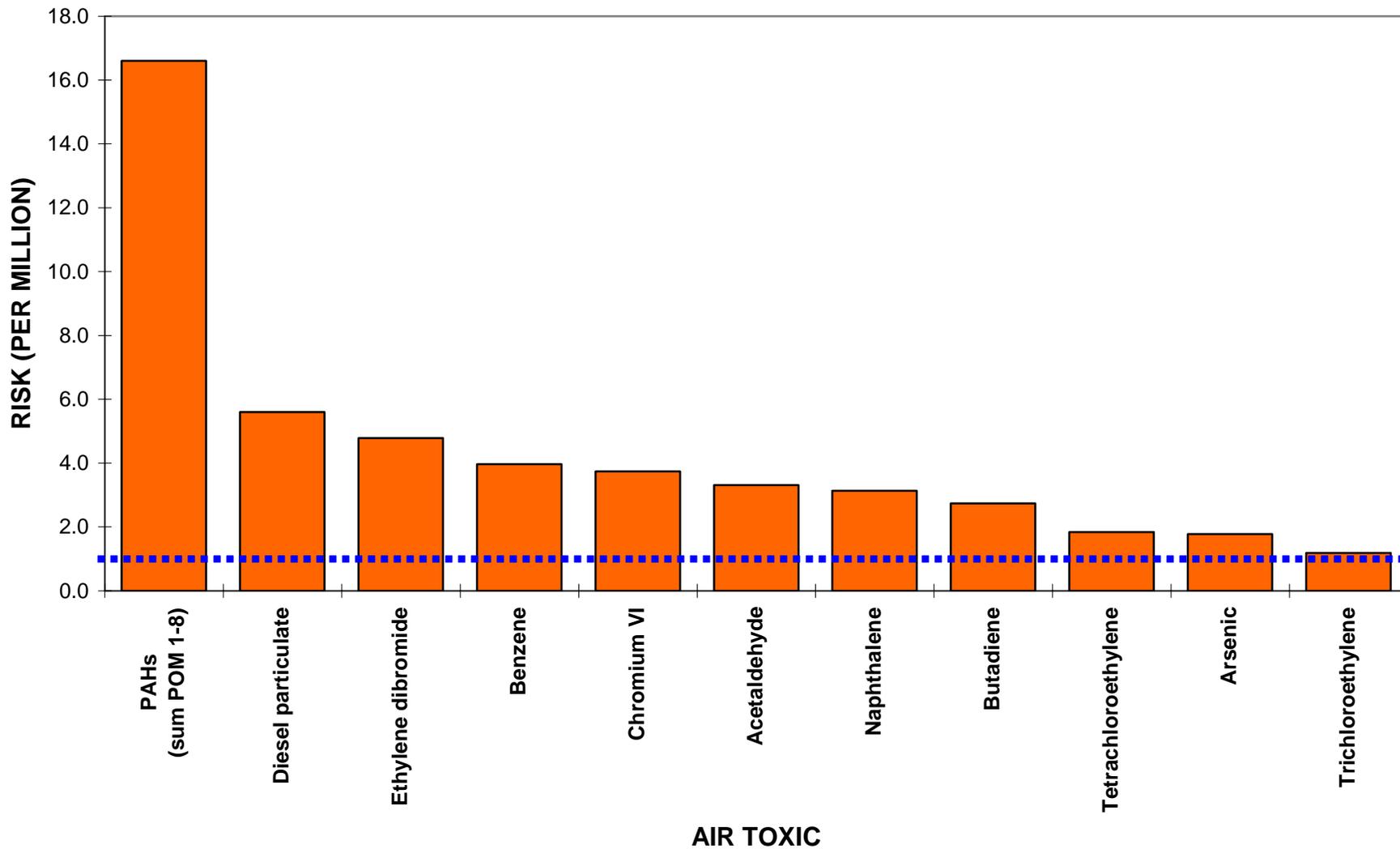
- 1999 NATA results (PAH from woodstoves) triggered a review of the Residential Wood Combustion EI method
- Finding: Oregon RWC statewide survey results open to interpretation, affecting activity estimates
- Re-evaluate % of wood burning households

## SOURCES OF CANCER AIR TOXICS (NATA 1999)



	Major	Area and Other	Onroad Mobile	Nonroad Mobile	Background
National	9.7%	18.6%	23.7%	4.9%	43.1%
Oregon	28.7%	57.0%	4.9%	1.4%	8.0%

**AIR TOXICS CONTRIBUTING TO CANCER RISK IN OREGON**  
**(NATA 1999 Exposure Estimates ~ Oregon Ambient Benchmarks)**



# RWC Method



Estimated Emissions = Activity \* Emission Factors

## Where

Activity

= tons wood burned

= estimated using 1993 & 2000 Statewide survey results

Emission Factors

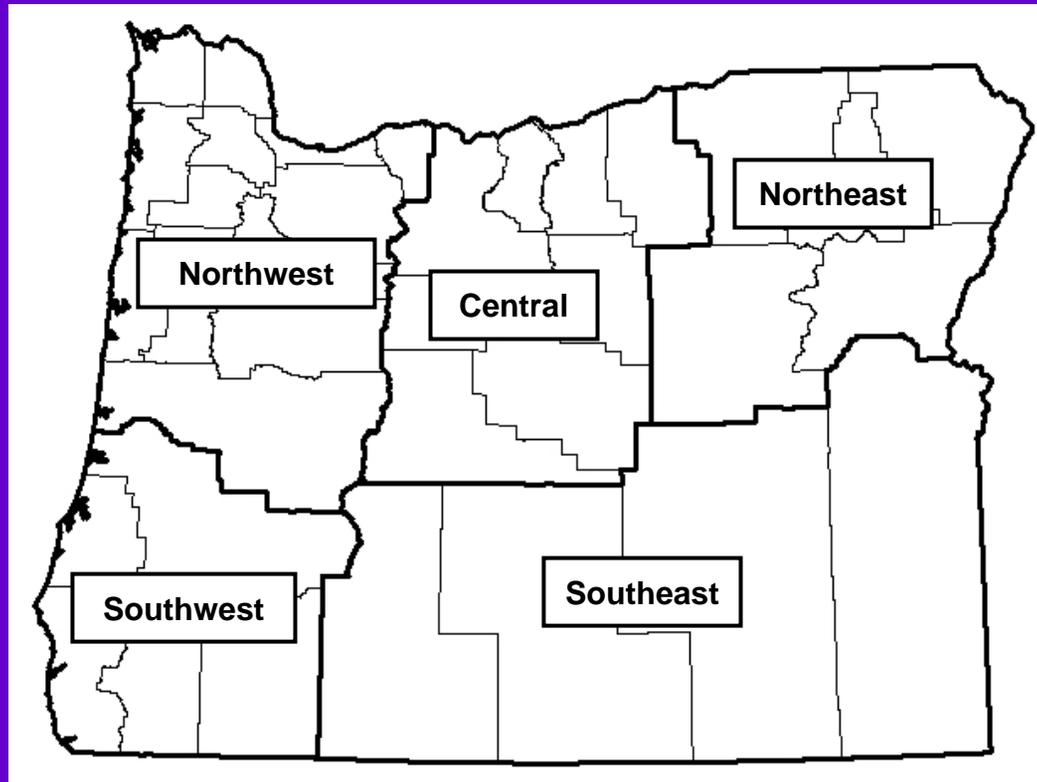
= specific to pollutant and device type

= taken from EPA, EIIP, and OMNI documentation..



# Activity: 1993 and 2000 Statewide Woodheating Surveys

- 1993 (mail in): wood species
- 2000 (cold-call): Region 10: All other activity data
- Surveys divided into five regions to accommodate spatial allocation required by the CERR
- Regions:



# Activity: Device Type



- From 2000 survey results
- 55% of respondents (471 of 856) own a wood heating device: fireplace, insert, woodstove, or pellet stove
- Woodstove and insert survey results allocated using EPA 2002 NEI:

Type of Device	Percent of Total Wood Combustion
Non-certified	92%
Certified non-catalytic	5.7%
Certified catalytic	2.3%

2002 NEI documentation, Appendix A, p. A-152.

# Activity: Statewide Average Heating Device Type Allocation



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Woodstove: general (non-certified)	19.0%
Fireplace; general	17.7%
Insert: non-EPA certified	11.1%
Non-Catalytic woodstove: pellet stove	4.7%
Non-Catalytic woodstove: general (certified)	1.2%
Insert: EPA certified, non-catalytic	0.7%
Catalytic Woodstove: general (certified)	0.5%
Insert: EPA certified, catalytic	0.3%

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Total RWC Device Ownership = 55% of all HouseHolds



# Activity: Tons Wood Burned

- 23% of respondents (201 out of 856) indicated number of cords burned in 2000 (2000 survey)
  - 2.1 to 3.8 cords per household (by State region)
- Cord mass estimated at 1.79 to 1.83 tons per cord (by State region)
  - Cord density estimated using 1993 survey results (wood species/type) and AP-42 data (species wood density)



# Activity: Tons Wood Burned

Tons Cordwood Burned by County = (a) \* (b) \* (c) \* (d) \* (e)

Where

- (a) = county 2002 housing units (Census Bureau)
- (b) = % device ownership (survey)
- (c) = cords wood burned per housing unit (survey)
- (d) = estimated cord mass (survey)
- (e) = county 2002/2000 Heating Degree Day ratio

And

(b), (c), (d) specific to State region

# Emission Factors



- 2002 NEI documentation (fireplaces, inserts, and woodstoves)
- Pellet stoves = AP-42, EIIP (STAPPA-ALAPCO), and OMNI Environmental

# Results: 2002 Estimated Statewide Emissions



Description	CO (tons)	NOX (tons)	PM2.5 (tons)	VOC (tons)
Fireplaces: General	96,017	1,950	17,703	171,780
Fireplaces: Insert; non-EPA certified	79,809	967	10,572	18,311
Fireplaces: Insert; EPA certified; non-catalytic	3,018	*	420	257
Fireplaces: Insert; EPA certified; catalytic	898	17	176	130
Woodstoves: General (non-certified)	109,461	1,327	14,500	25,114
Catalytic Woodstoves: General (certified)	1,232	24	242	178
Non-catalytic Woodstoves: General (certified)	4,140	*	575	352
Non-catalytic Woodstoves: Pellet Fired	650	228	68	*
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<b>Totals</b>	<b>295,224</b>	<b>4,513</b>	<b>44,256</b>	<b>216,121</b>

\* Emission Factor data not available

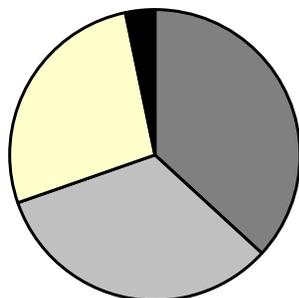
# Results: 2002 Estimated Statewide Emissions



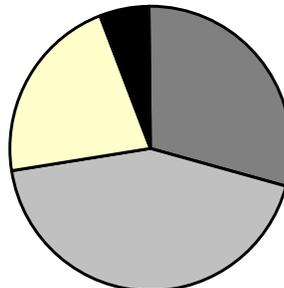
Description	16-PAH (tons)	Benzene (tons)	Dioxin/ Furan (lbs)	Other HAPs (tons)
Fireplaces: General	*	*	5.E-07	*
<b>Fireplaces: Insert; non-EPA certified</b>	<b>154</b>	<b>670</b>	<b>4.E-04</b>	<b>425</b>
Fireplaces: Insert; EPA certified; non-catalytic	4	*	3.E-05	0.5
Fireplaces: Insert; EPA certified; catalytic	2	13	1.E-05	7
<b>Woodstoves: General (non-certified)</b>	<b>211</b>	<b>919</b>	<b>6.E-04</b>	<b>583</b>
Catalytic Woodstoves: General (certified)	2	17	1.E-05	9
Non-catalytic Woodstoves: General (certified)	5	*	4.E-05	0.7
Non-catalytic Woodstoves: Pellet Fired	0.004	*	*	*
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<b>Totals</b>	<b>378</b>	<b>1,619</b>	<b>0.001</b>	<b>1,025</b>

\* Emission Factor data not available

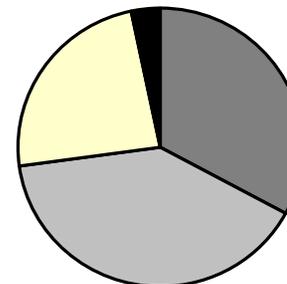
# Results: Oregon 2002 Estimated RWC Emissions



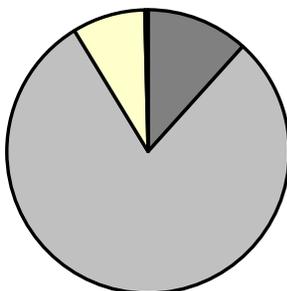
CO



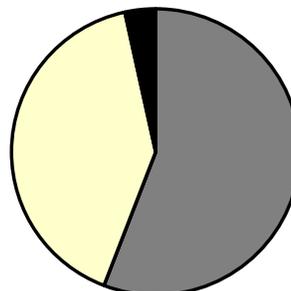
NOX



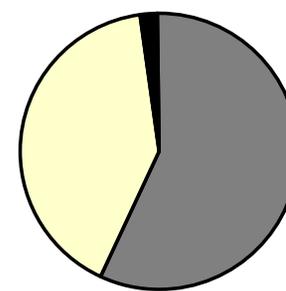
PM2.5



VOC



16-PAH\*



Benzene\*

■ Woodstoves: General (non-certified) ■ Fireplaces: General  
■ Fireplaces: Insert; non-EPA certified ■ All Others

\* No data for emission factors for "Fireplaces: General"

# Discussion



- Why do estimates for fireplaces, non-certified inserts/woodstoves contribute such a large portion to the RWC emissions estimates pie?
  - (fireplace + non-certified insert + non-certified stove) ÷ (RWC total):
    - ✓ 59% of lbs criteria pollutants per ton wood burned
    - ✓ 87% of all devices
    - ✓ 95% of all wood burned

# Discussion (continued)



- Why are emissions estimates so large compared to National data?
  - ✓ 55% housing units burn wood as a heating fuel (assumed equal to device ownership)
  - ✓ 12.3% of Oregon occupied housing units use wood as a heating fuel (2000 Census)

# Recommendation: re-evaluation of survey results



## Estimated Percentage of Woodburning Housing Units in Oregon, by Region

	Central	Northeast	Northwest	Southeast	Southwest
<b>DEQ Current Estimates<sup>1</sup></b>					
	54.9%	57.8%	56.7%	51.2%	54.7%
<b>Revised Estimates<sup>2</sup></b>					
	35.0%	31.2%	20.0%	26.0%	28.4%
<b>2000 Census<sup>3</sup></b>					
	17.8%	21.5%	8.5%	17.7%	15.5%

### Notes:

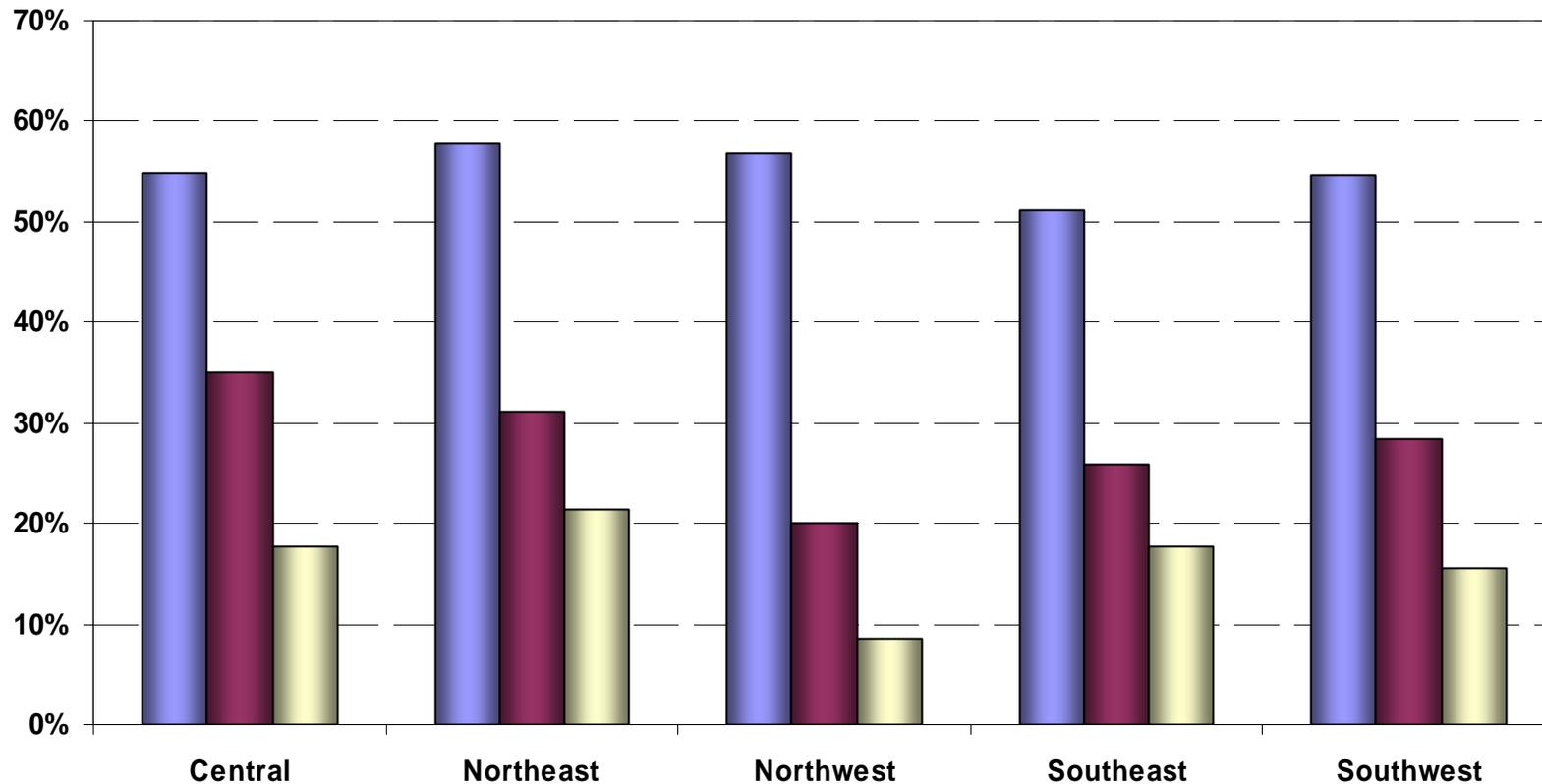
(1) Total Device Ownership from the 2000 survey (471 respondents out of 856 completed interviews)

(2) Percentage equals only those respondents reporting volume cordwood or tons pellets burned in the 2000 survey (228 respondents out of 856 completed interviews)

(3) US Census Bureau, 2000 data, H40 House Heating Fuel



## Woodburning Housing Units in Oregon



- device ownership (survey)
- respondents reporting wood burned (survey)
- Census

# Other Recommendations



- Future surveys:
  - Device questions should be linked to volume/mass of wood burned
  - Distinguish between recreational and home heating activity: is wood the primary heating fuel for the household?

# Other Recommendations – cont'd



- Future surveys:
  - Species/type of wood burned (including manufactured firelogs)
  - Device certification
- More research needed into emission factors

Somewhere, near the little house on the prairie, Doc Baker says,



EPA, please send the states more \$\$ for RWC surveys and inventory work,

Before Walnut Grove has another exceedance