

LIBBY ASBESTOS SUPERFUND SITE
DRAFT
SITE-WIDE CUMULATIVE
HUMAN HEALTH RISK ASSESSMENT



What Does a Risk Assessment Contribute to Site Decision-Making?



- Consistent process for evaluating and documenting public health and ecological threats.
- The risk assessment provides some of the information for making cleanup decisions at any Superfund site.
 - Toxicity of contaminants of potential concern (LA)
 - Exposure and risk estimates
 - Is some action recommended?



Source Media

- **Vermiculite insulation**
 - Indoor dust
- **Vermiculite-containing soil**
 - Outdoor soil (yards, gardens)
- **Mine waste materials**
 - Outdoor soil (driveways, roads, mine site)
- **Tree bark**
 - Woodchips/mulch
 - Wood-derived ash

Exposure Media = Air

- **Outdoor Air**
 - Under ambient conditions
 - During outdoor source media disturbance activities
 - Soil/duff, tree bark, woodchip/mulch
- **Indoor Air**
 - Under passive conditions
 - During indoor source media disturbance activities
 - Vermiculite insulation, indoor dust, woodstove ash

Activity-Based Sampling Scenarios



Ambient Air

10 years, 6 Libby locations, 3 Troy locations
Helena and Eureka

Recreational, Outdoor

Hiking/camping in forested areas – OU3 and OU4
Hiking along Rainy Creek
Fishing/boating along Kootenai River
Motocross track
Bike Paths
ATV riding in fields and forested areas

Wood Harvesting

Cutting and hauling firewood
Commercial logging
Hand tree felling
Hooking and Skidding of felled trees
Site restoration activities
Chipping
Mechanical processing

USFS Worker, Outdoor

Forest management
Cutting fire lines

Driving, Biking, etc

Rainy Creek Road
Libby Roads
Troy Roads

Residential

Passive – Indoors
Active - Indoors
Mowing, Digging, Raking - 5 soil conditions
Gardening – 5 soil conditions
Child soil playing – 5 soil conditions
Child playing - gravel driveway

Occupational, Outdoor

16 Occupational settings

Occupational, Indoor

23 Occupational settings

Schools, Indoor and Outdoor

Kootenai Valley Head Start
Libby Elementary School
Libby Middle School
Libby High School
Libby Administration Building

Background

28 Locations throughout valley & borrow pits



Libby Amphibole Toxicity Assessment

Libby Amphibole Asbestos Toxicity Values



Inhalation
Toxicity Value

1988
"Asbestos"

2011
Draft LA

2014
Final LA

IUR* (Cancer)

0.23 per fibers/cc

0.17 per fibers/cc

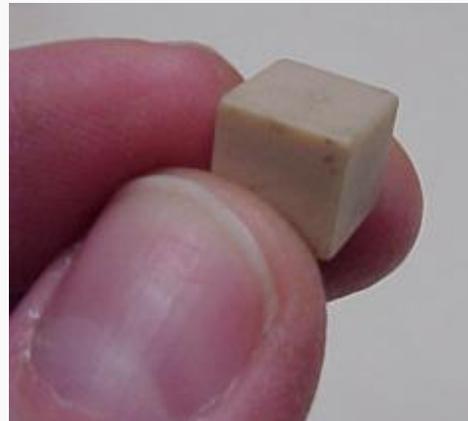
0.17 per fibers/cc

RfC# (Noncancer)

No value

0.00002 fibers/cc =
20 fibers/m³

**0.00009 fibers/cc
= 90 fibers/m³**



cc



m³

*IUR = Inhalation Unit Risk

#RfC = Reference Concentration



Human Health Risk Assessment

Relationship Between Cancer Risk and Noncancer Hazard for Libby Amphibole



	Cancer Risk		Noncancer Hazard	
Increasing Risk ↑	0.0001	1E-4	10	↑ Increasing Hazard
	0.00001	1E-5	1	
	0.000001	1E-6	0.1	



Target Risk Range for Cancer Causing Chemicals

1×10^{-6} to 1×10^{-4}

Target Hazard for Non-Cancer Chemicals

Hazard Index = 1

A level at which it is unlikely that even sensitive populations will experience adverse health effects such as localized pleural thickening.

How EPA Calculates Cancer Risk and Noncancer Hazard



Estimated Risks from Exposure to LA in Ambient Air Libby Asbestos Superfund Site

Panel A: Risk Estimates Based on RME Exposure Parameters

Exposure Media	Receptor Population	Exposure Location	EPC	Exposure Parameters				Cancer Risk	Non-cancer HQ
			Mean Air Conc. (PCME LA s/cc) ⁺	ET (hours/day)	EF (days/year)	ED (years)	TWF		
Outdoor air, under ambient conditions	Resident	Libby	0.0000062	6.9	350	50	0.20	2E-07	0.01
		Within community	0.0000048	6.9	350	50	0.20	2E-07	0.01
		Along transportation corridors	0.0000098	6.9	350	50	0.20	3E-07	0.02
		Troy	0.0000015	6.9	350	50	0.20	5E-08	0.003
	Recreational visitor	OU3, mine site	0.00020	8	50	50	0.033	1E-06	0.07

Panel B: Risk Estimates Based on CTE Exposure Parameters

Exposure Media	Receptor Population	Exposure Location	EPC	Exposure Parameters				Cancer Risk	Non-cancer HQ
			Mean Air Conc. (PCME LA s/cc) ⁺	ET (hours/day)	EF (days/year)	ED (years)	TWF		
Outdoor air, under ambient conditions	Resident	Libby	0.0000062	1.6	350	25	0.023	2E-08	0.002
		Within community	0.0000048	1.6	350	25	0.023	2E-08	0.001
		Along transportation corridors	0.0000098	1.6	350	25	0.023	4E-08	0.002
		Troy	0.0000015	1.6	350	25	0.023	6E-09	0.0004
	Recreational visitor	OU3, mine site	0.00020	8	25	25	0.0082	3E-07	0.02

CTE - central tendency exposure
ED - exposure duration
EF - exposure frequency

EPC - exposure point concentration
ET - exposure time
LA - Libby amphibole asbestos

HQ - hazard quotient
OU - operable unit
PCME - phase contrast microscopy-equivalent

RME - reasonable maximum exposure
s/cc - structures per cubic centimeter
TWF - time-weighting factor

How EPA Calculates Cancer Risk and Noncancer Hazard

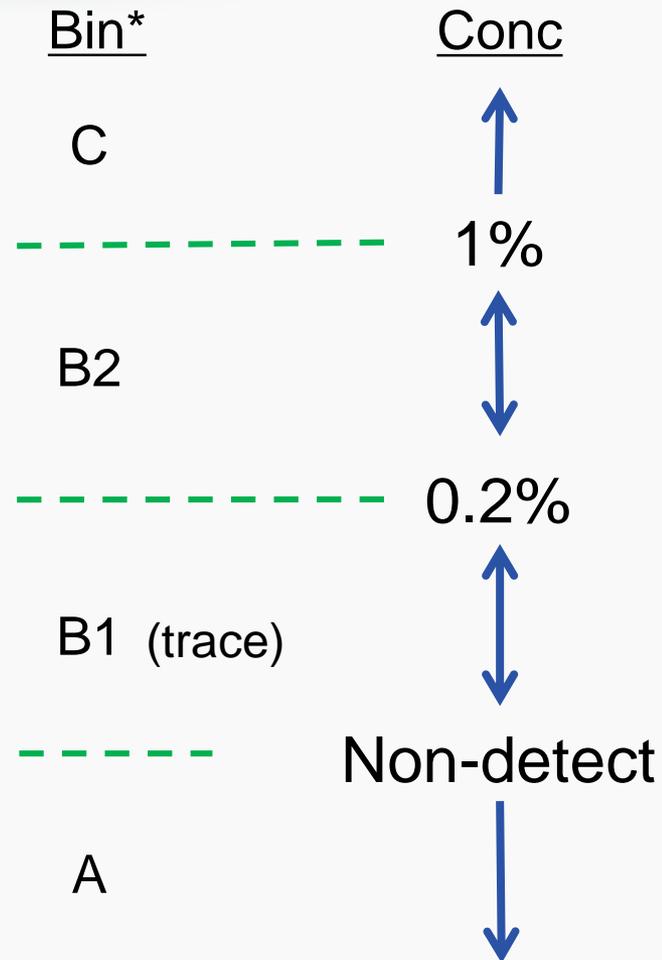


Estimated Residential Risks from Exposure to LA from Indoor Air in OU4 and OU7

Libby Asbestos Superfund Site

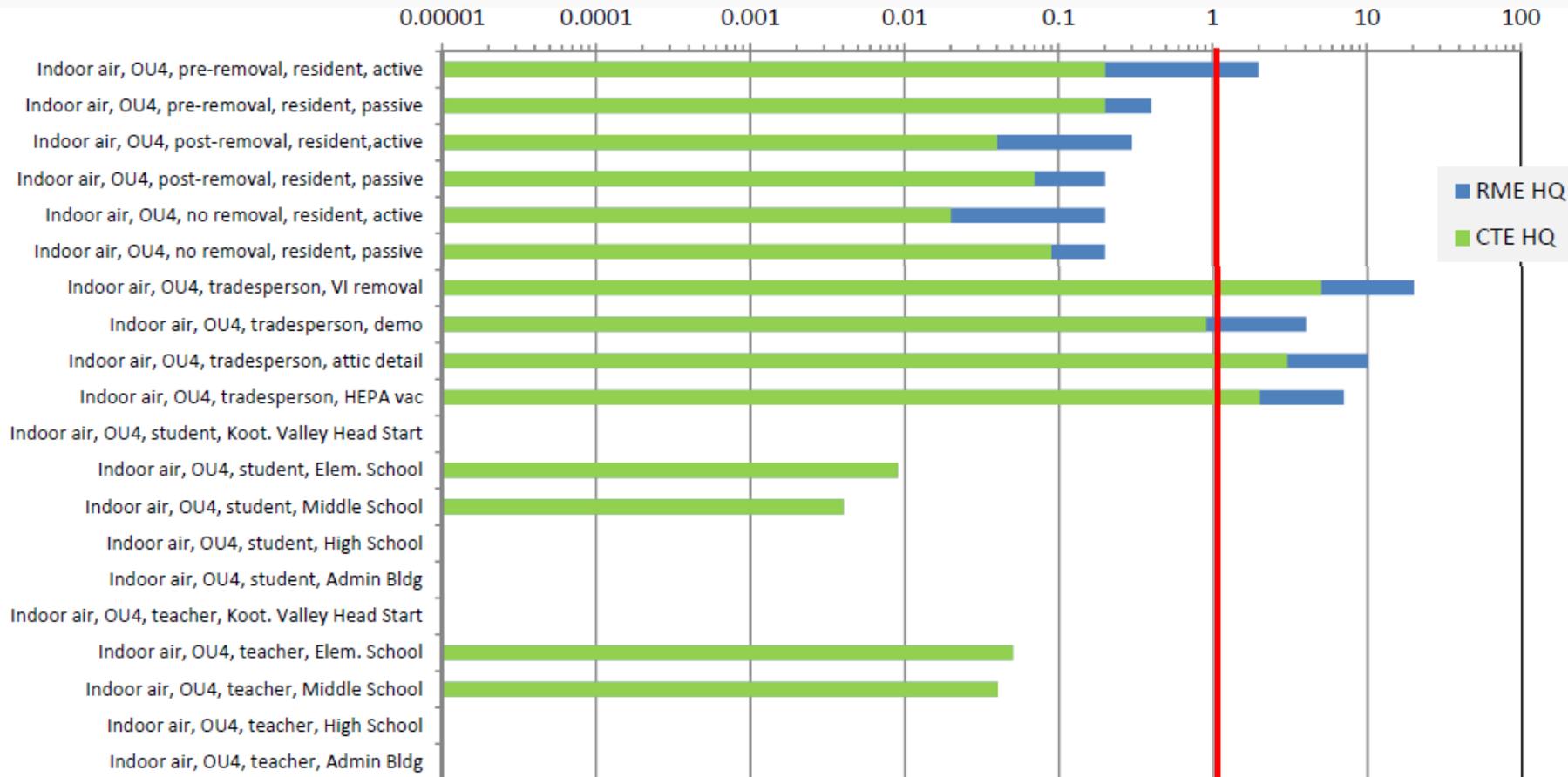
Receptor Type	Building Description	Exposure Scenario	EPC	Exposure Parameters				Cancer Risk	Non-cancer HQ
			Mean Air Conc. (PCME LA s/cc) ⁺	ET (hours/day)	EF (days/year)	ED (years)	TWF		
Resident	Residential Properties - "Pre-Removal"	Active Behaviors	0.00099	5.8	350	50	0.17	3E-05	2
		Passive Behaviors	0.000068	16.9	350	50	0.48	6E-06	0.4
		Total:						3E-05	2
	Residential Properties - "Post-Removal"	Active Behaviors	0.00018	5.8	350	50	0.17	5E-06	0.3
		Passive Behaviors	0.000032	16.9	350	50	0.48	3E-06	0.2
		Total:						8E-06	0.5
	Residential Properties - "No Removal"	Active Behaviors	0.000095	5.8	350	50	0.17	3E-06	0.2
		Passive Behaviors	0.000038	16.9	350	50	0.48	3E-06	0.2
		Total:						6E-06	0.4

Soil Asbestos Categories

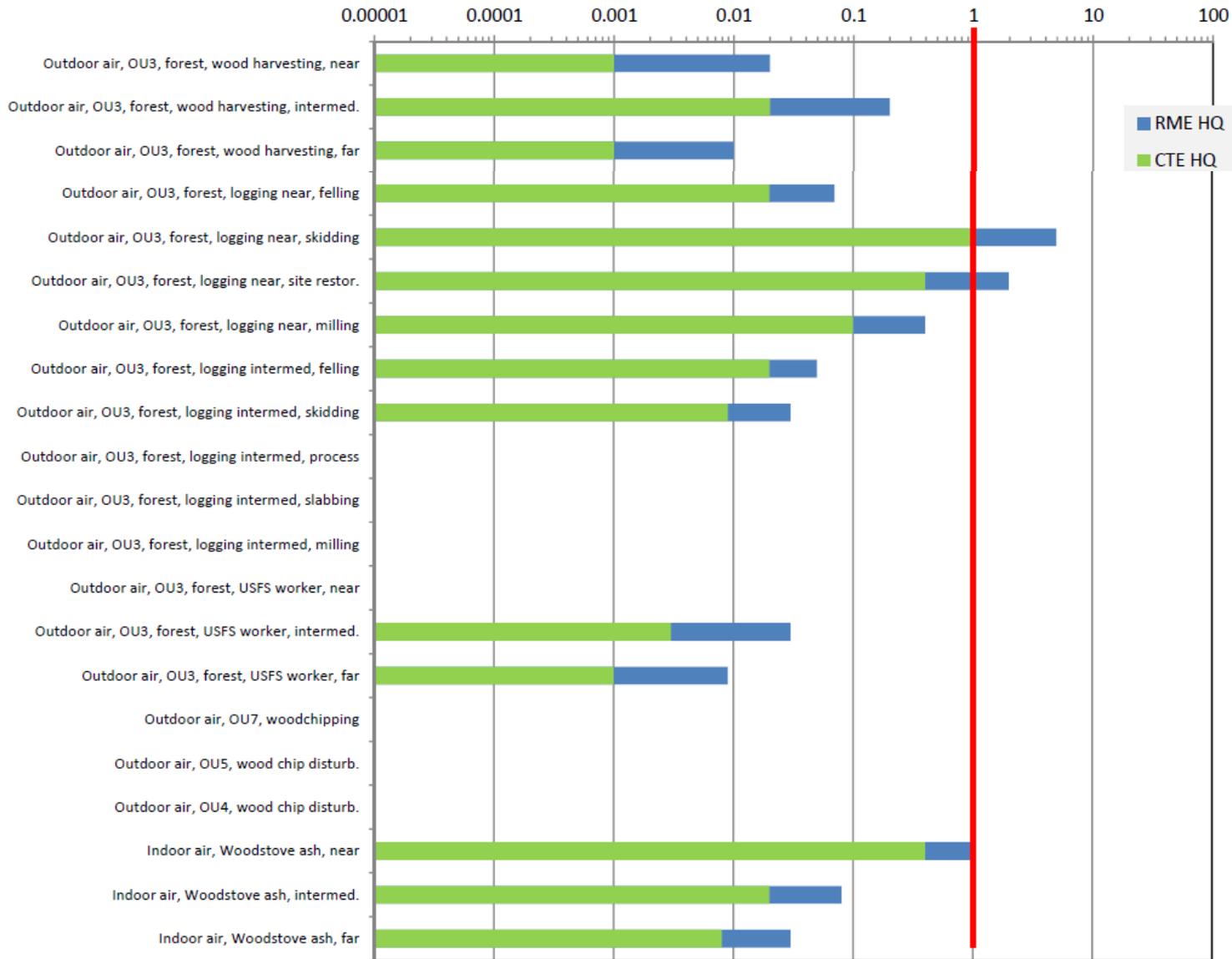


* The term Bin is used to describe a category of asbestos contamination.

Individual Exposure Scenario Noncancer Hazards



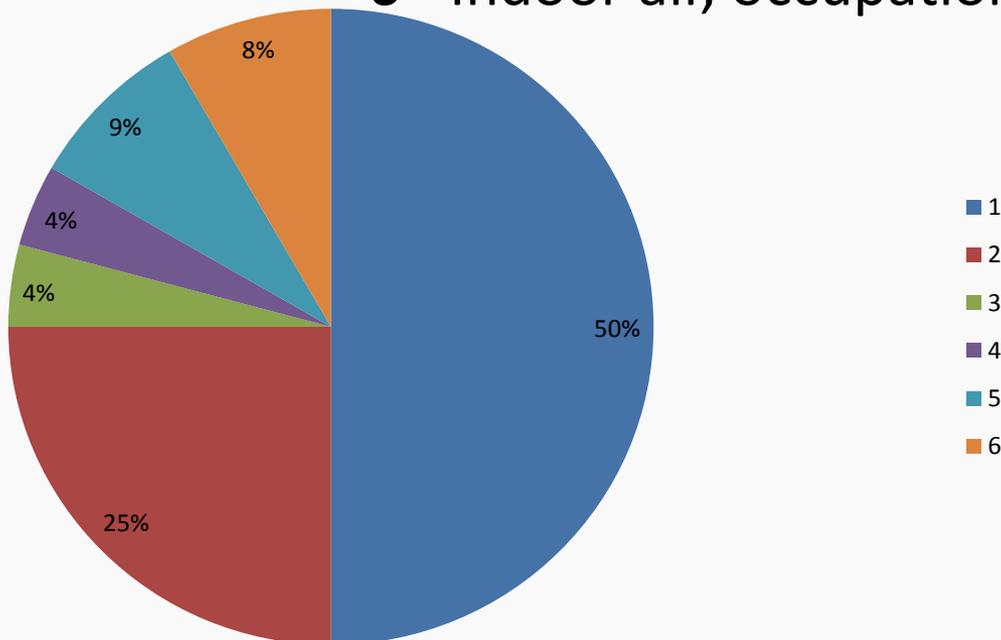
Individual Exposure Scenario Noncancer Hazards



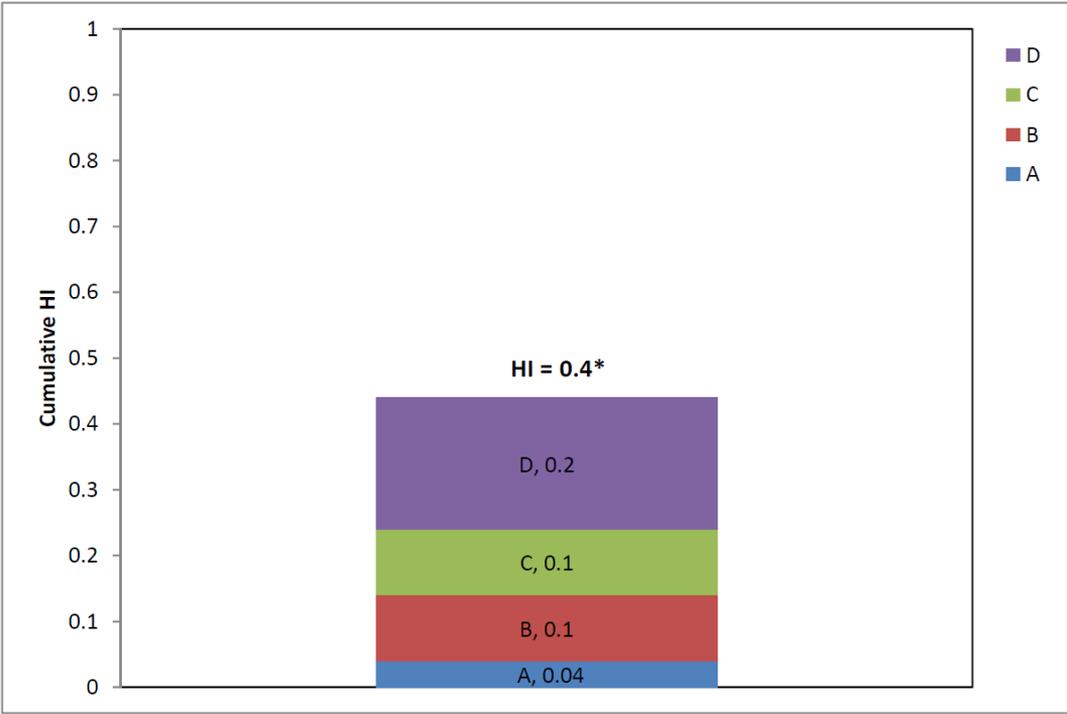
Example Exposure Summation



	<u>Activity</u>	<u>Hours</u>	<u>Percent of Total</u>
1	Indoor air, passive activity, C_1	12	50
2	Outdoor yard work, C_2	6	25
3	Outdoor air, driving car, C_3	1	4
4	Outdoor air, hunting, C_4	1	4
5	Outdoor air, hiking south of Libby, C_5	2	8
6	Indoor air, occupational, C_6	2	8
			100

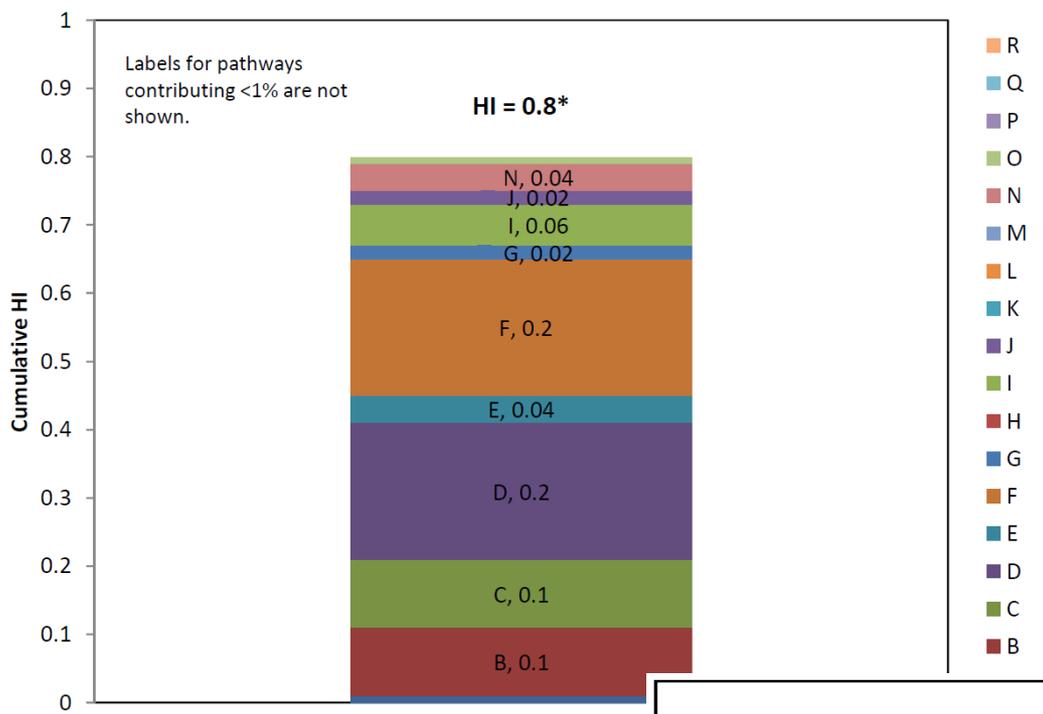


Baseline Residential Scenario



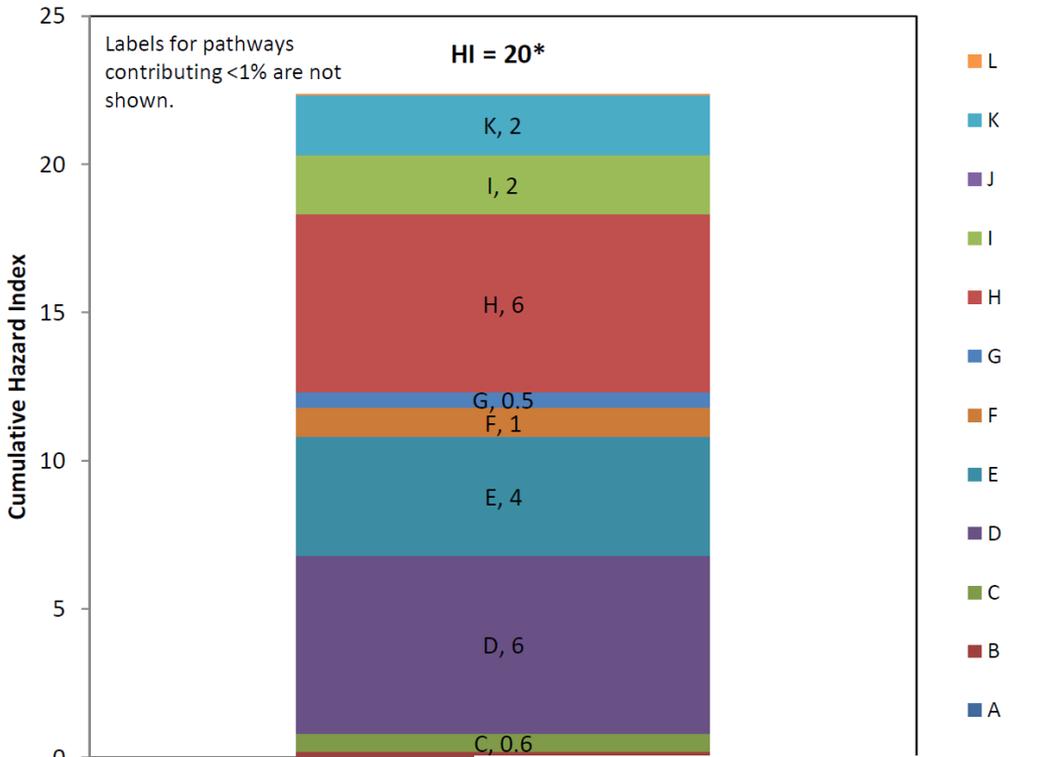
Exposure Scenario		TWF		Risk Estimates		
		Value	% of total	Risk	HQ	% of total
A	Ambient air, OU4	0.57	57%	6E-07	0.04	10%
B	Indoor air, OU4, post-removal, resident, passive	0.33	33%	2E-06	0.1	25%
C	Indoor air, OU4, post-removal, resident, active	0.05	5%	2E-06	0.1	25%
D	Outdoor air, yard soil, curb-to-curb	0.05	5%	3E-06	0.2	50%
cumulative*:		1.000		7E-06	0.4	

Post-Removal, Life-Long Residential Scenario



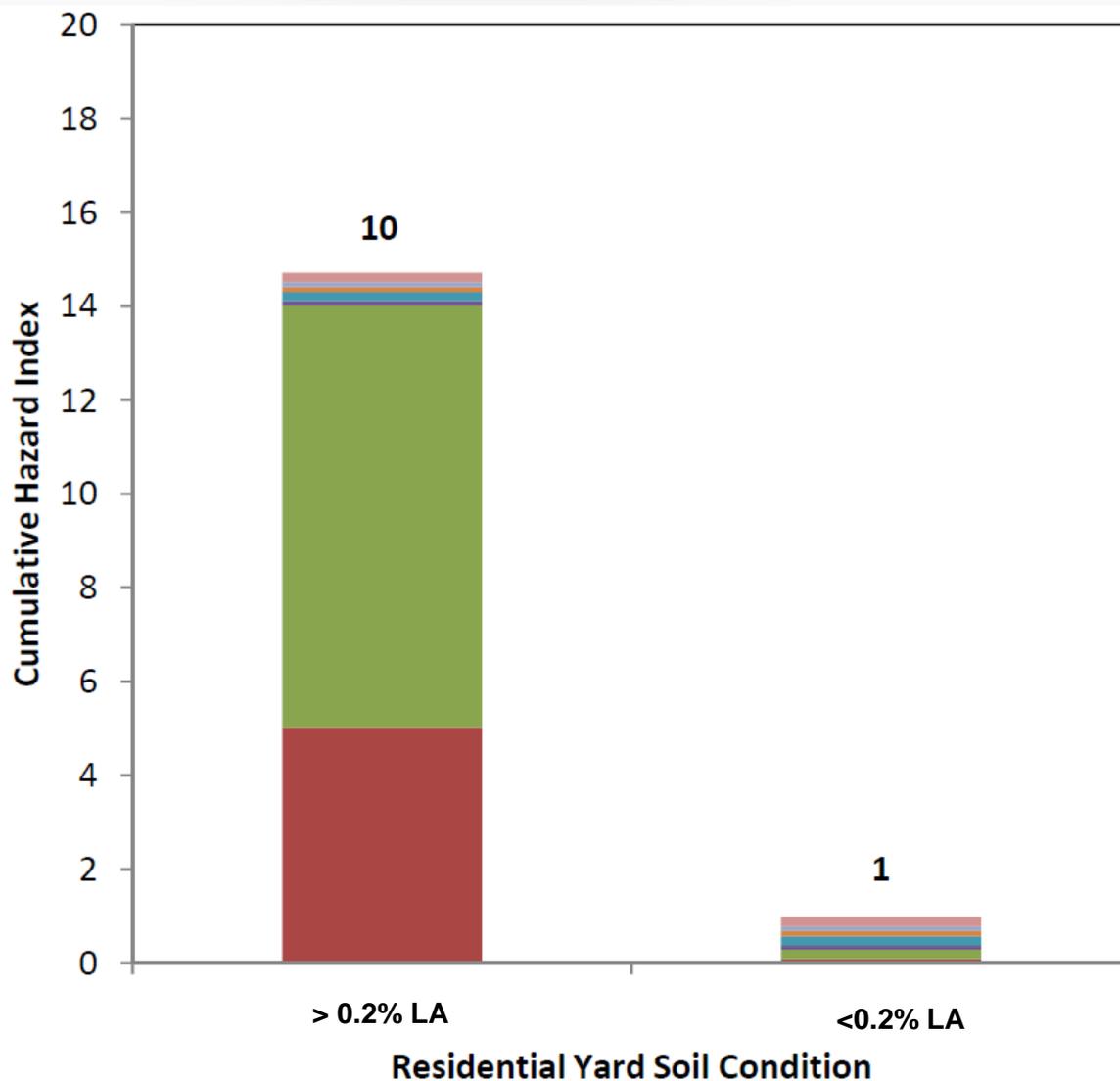
Exposure Scenario		TWF		Risk Estimates		
		Value	% of total	Risk	HQ	% of total
A	Ambient air, OU4	0.15	15%	2E-07	0.01	1%
B	Indoor air, OU4, post-removal, resident, passive	0.33	33%	2E-06	0.1	13%
C	Indoor air, OU4, post-removal, resident, active	0.05	5%	2E-06	0.1	13%
D	Outdoor air, yard soil, curb-to-curb	0.05	5%	3E-06	0.2	25%
E	Indoor air, OU4, no removal, worker, passive	0.1	10%	7E-07	0.04	5%
F	Indoor air, OU4, no removal, worker, active	0.1	10%	4E-06	0.2	25%
G	Outdoor air, OU4, Libby Middle, student	0.00082	0.08%	3E-07	0.02	3%
H	Outdoor air, OU4, Koot. Valley HS, student	0.0016	0.2%	0E+00	0	0%
I	Outdoor air, OU4, Libby Elem., student	0.0029	0.3%	9E-07	0.06	8%
J	Indoor air, OU4, student, Elem. School	0.037	4%	4E-07	0.02	3%
K	Outdoor air, OU7, Golf course, adult	0.012	1%	0E+00	0	0%
L	Outdoor air, OU4, biking, adult	0.013	1%	0E+00	0	0%
M	Outdoor air, OU5, MotoX, participant	0.012	1%	0E+00	0	0%
N	Outdoor air, OU4, LUA soil, ATV, A	0.0030	0.3%	6E-07	0.04	5%
O	Outdoor air, OU3, forest, hiking, far	0.0030	0.3%	1E-07	0.008	1%
P	Outdoor air, OU3, Kootenai, fishing	0.015	1%	0E+00	0	0%
Q	Outdoor air, OU8, Driving in Libby	0.020	2%	0E+00	0	0%
R	Offsite	0.1	10%	0E+00	0	0%
cumulative*:		1.000		1E-05	0.8	

Pre-Removal Residential Scenario



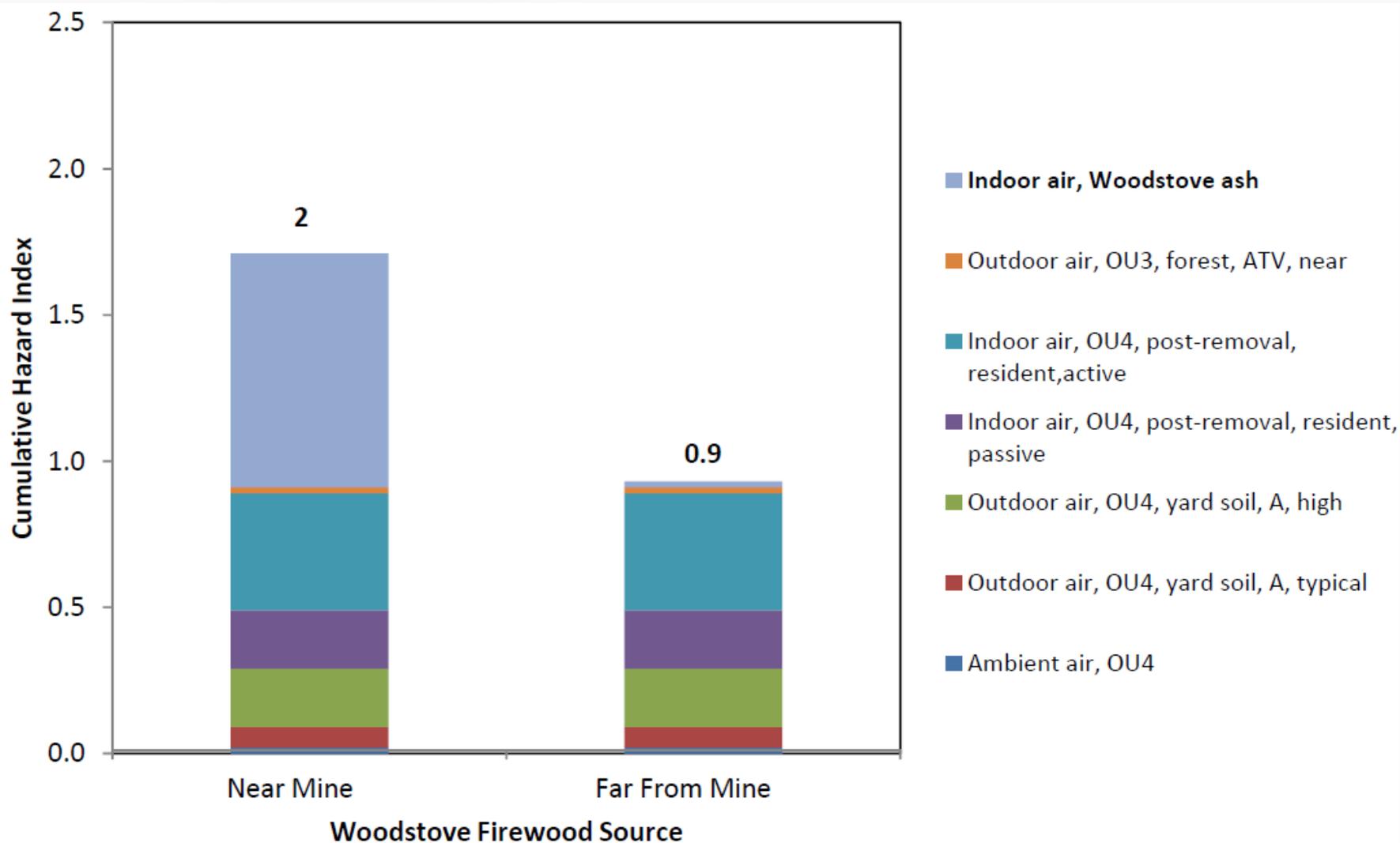
Exposure Scenario		TWF		Risk Estimates		
		Value	% of total	Risk	HQ	% of total
A	Ambient air, OU4	0.15	15%	2E-07	0.01	0.1%
B	Indoor air, OU4, pre-removal, resident, passive	0.3	30%	3E-06	0.2	1%
C	Indoor air, OU4, pre-removal, resident, active	0.05	5%	8E-06	0.6	3%
D	Outdoor air, OU4, yard soil, B2/C, high	0.0025	0.3%	9E-05	6	30%
E	Outdoor air, OU4, yard soil, B2/C, typical	0.0473	5%	6E-05	4	20%
F	Outdoor air, OU4, subsurface soil, resident, B2/C	0.0002	0.02%	2E-05	1	5%
G	Indoor air, OU4, pre-removal, worker, passive	0.154	15%	7E-06	0.5	3%
H	Indoor air, OU4, pre-removal, worker, active	0.15	15%	8E-05	6	30%
I	Outdoor air, OU3, Rainy Creek, hiking	0.02	2%	3E-05	2	10%
J	Outdoor air, OU3, forest, wood harvesting, near	0.01	1%	2E-07	0.02	0.1%
K	Indoor air, Woodstove ash, near	0.001	0.1%	2E-05	2	10%
L	Outdoor air, OU8, ATV	0.015	2%	5E-07	0.03	0.2%
M	Offsite	0.1	10%	0E+00	0	0%
cumulative*:		1.00		3E-04	20	

Residential Outdoor Properties No Removal vs. Removal

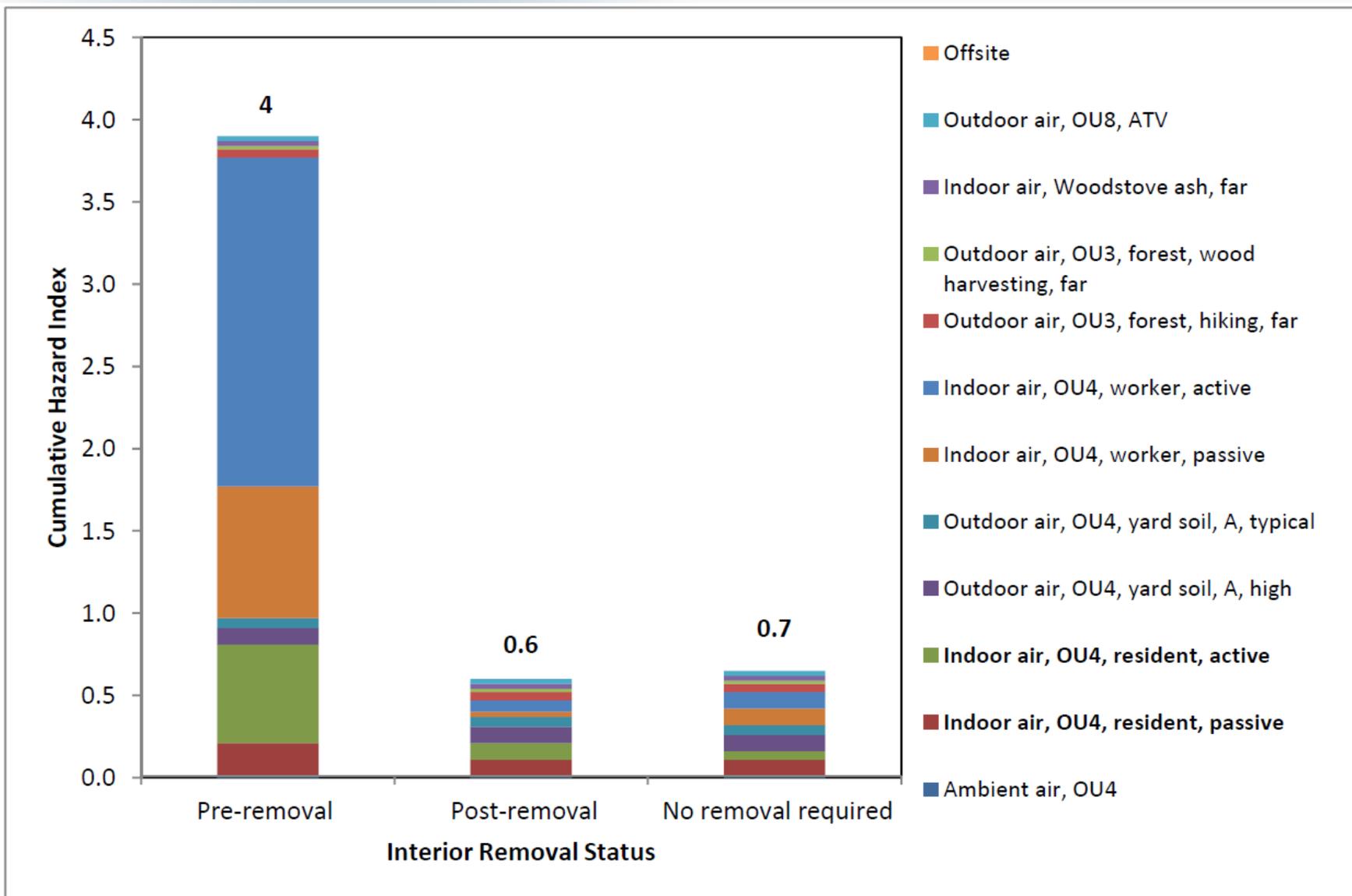


- Indoor air, OU4, no removal, commercial worker, active behavior
- Indoor air, OU4, no removal, commercial worker, passive behavior
- Outdoor air, OU3, Rainy Creek, hiking
- Indoor air, OU4, post-removal, resident, active behavior
- Indoor air, OU4, post-removal, resident, passive behavior
- Outdoor air, OU4, yard soil, high intensity
- Outdoor air, OU4, yard soil, typical intensity
- Ambient air, OU4

Burning Home Heating Wood Mine Area vs. Far From Mine



Residential Indoor Properties No Removal vs. Removal



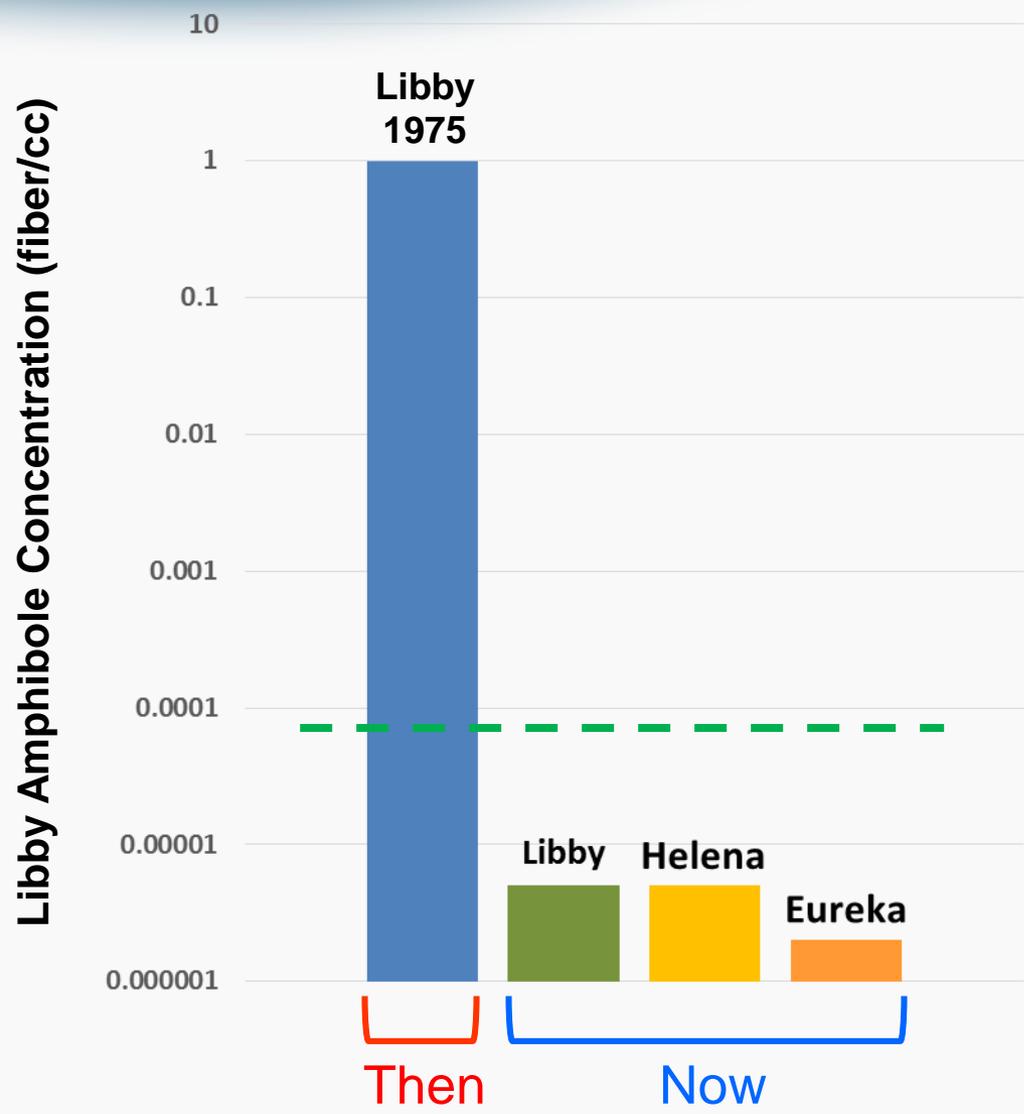


- It is possible to live and work in Libby and Troy Montana without excessive LA exposure and risk above EPA targets.
 - Residential exposures can be reduced significantly by conducting indoor cleanups (HQ 2 to 0.5) and yard cleanups (HQ 6 to 0.1).
- Outdoor air concentrations are currently equivalent to other Montana cities.
 - LA air concentration is ~100,000 times lower than when mine and processing facilities were in operation.
- The schools and school yards have been cleaned to acceptable levels of exposure and risk.



- Higher exposures are associated with:
 - Yard work when soil asbestos is greater than 0.2% LA
 - Some activities near the Vermiculite Mine
 - Hiking along Rainy Creek
 - Brush-hogging along some highway areas
 - Career tradesperson conducting renovations in homes with vermiculite
 - Some logging activities (such as skidding and site restoration) near the mine
 - Handling ash when wood is collected near the mine for residential use

Libby Amphibole Asbestos Outdoor Air Concentrations - Then and Now



Next Steps



- Public review and comment on Site-Wide Human Health Risk Assessment
- Feasibility Study
- Proposed Plan
- Record of Decision