



# Did the **CHANGE-OUT** WORK?

*Five heating seasons have passed since the hearth industry replaced all the old, dirty-burning wood stoves in Libby; it's time to look at the results.*

**F**ive heating seasons have now passed since the wood stove change-out in Libby, Montana, was completed. For those of you who don't remember, the Hearth, Patio & Barbecue Association and its individual members teamed with the U.S. EPA, the Montana Department of Environmental Quality, and the Lincoln County Environmental Health Department to change-out *all* uncertified wood-burning devices in the small Montana community of Libby.

The majority of fine atmospheric particulate material – a.k.a. PM<sub>2.5</sub> – during the heating season in Libby has been identified to be from residential wood combustion. Additionally, historically Libby has been challenged by air pollution due to its deep valley setting with wintertime temperature inversions,

and an unrelated asbestos exposure from a now-abandoned mine and associated mill. Many of the residents of Libby are low income.

The Hearth, Patio & Barbecue Association (HPBA) and its members stepped up to the plate and contributed heaters, accessories and funding to make the change-out happen. Along with its partners, the U.S. EPA, the Montana Department of Environmental Quality, and the Lincoln County Environmental Health Department, the HPBA started change-outs in 2005 and made the last of the stove change-outs by the end of the 2007-2008 heating season. (For more details about the change-out the reader is referred to [www.hearthandhome.com](http://www.hearthandhome.com), click on Libby Articles on bottom of page).

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*A clear, sunny day in Libby, Montana.*

So, the million-dollar question is...

Did the change-out program improve air quality?

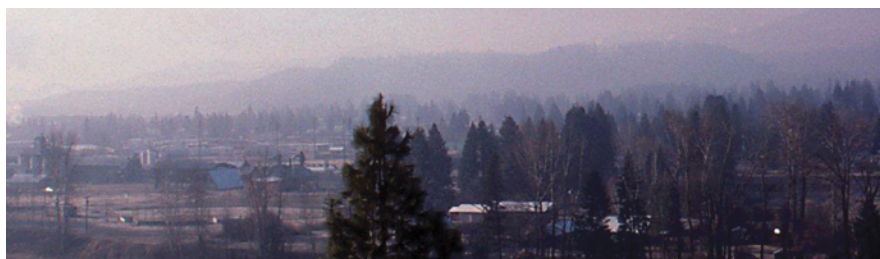
By all metrics, the answer is YES!

**First**, the number of episodic high 24-hour events above the 35 micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ) National Ambient Air Quality Standard dropped from six during the 2004-2005 heating season prior to the change-out program, to one, one, one and zero, respectively, during the four heating seasons after the change-out was completed. (The data for the most current 2012-2013 heating season is not yet available.)

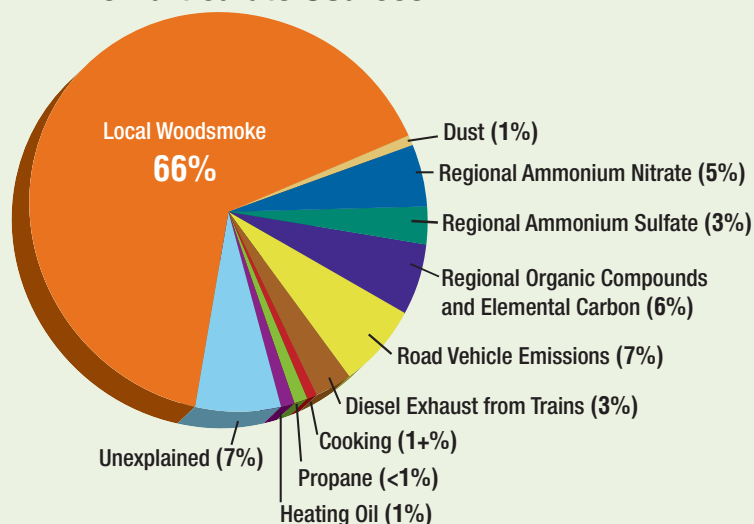
It's worth noting that these short-term high episodic events are often associated with triggering respiratory issues such as asthma attacks or cardiovascular incidents and are often the basis of the perception of poor air quality. A short-term high pollutant episode makes much more of an impression than the modest elevation of the long-term average.

**Second**, the average heating season concentration of  $\text{PM}_{2.5}$  decreased by about 30 percent before and after the change-out was completed. This means that the chronic exposure to fine particles was decreased significantly – but it's more than that. Besides the irritative effect of particles, the fine particles from wood combustion are made up of organic compounds, many of which are toxic, carcinogenic or mutagenic – but it's even more than that. Along with particles, volatile organic compounds (VOC) and carbon monoxide (CO) are emitted from wood combustion. As with fine particles, VOC (gases) from wood combustion include toxic, carcinogenic and mutagenic compounds, and everyone knows the issue with CO.

The good news is that the same complete combustion conditions that characterize new certified wood heaters in contrast to old uncertified ones will reduce all three categories of pollutants – fine particles, VOC and CO. Chronic exposure of Libby's residents to fine particles, organic air toxics and carbon monoxide were all reduced by the change-out.

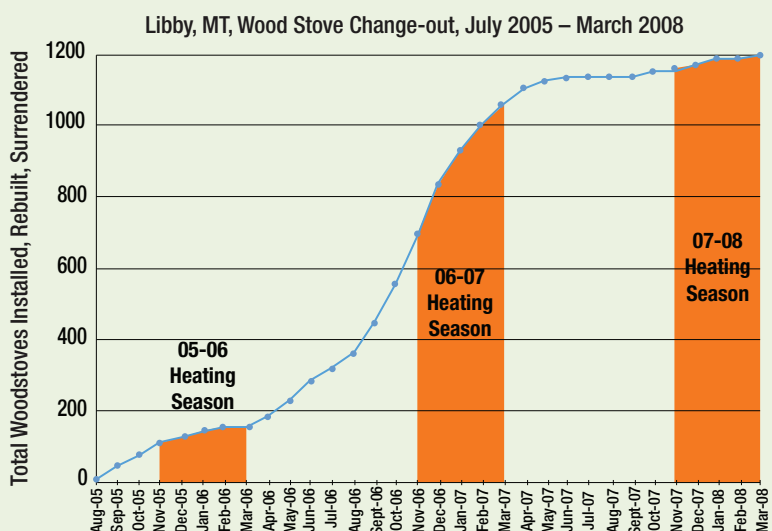


### Pre-Change-Out Fine Particulate Sources



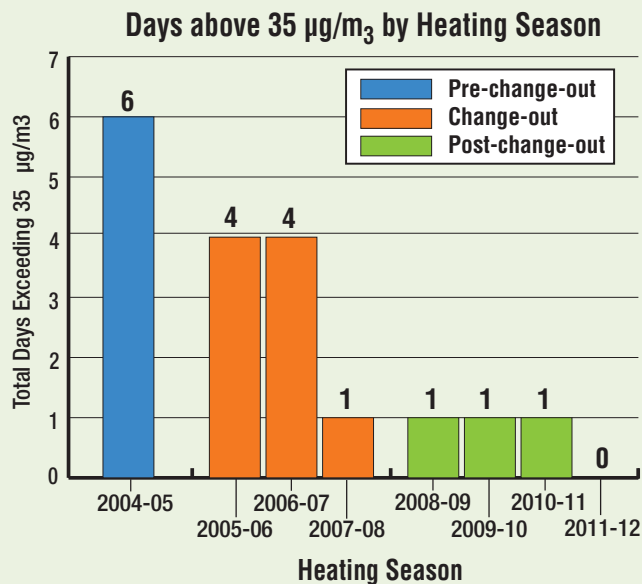
*Pre-change-out, residential wood combustion was estimated to contribute about 66 percent to atmospheric fine particulate levels in Libby during the heating season (November 1 through February 28/29).*

### Cumulative Count



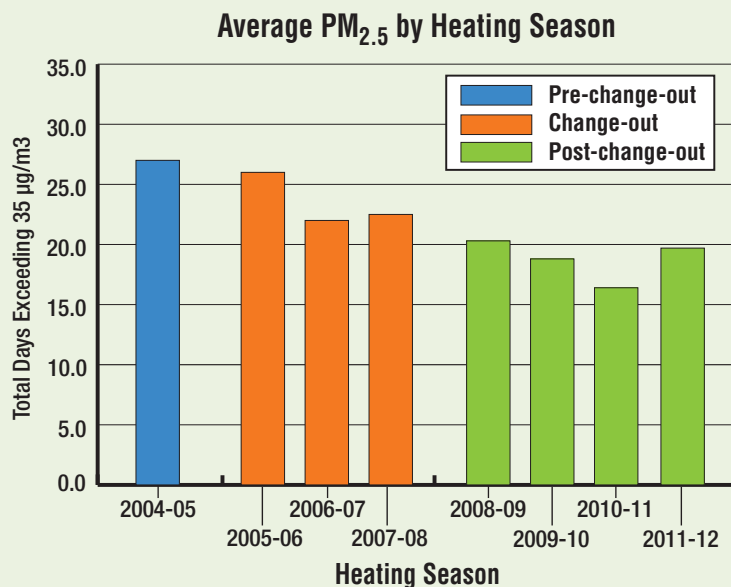
*The wood stove change-out program took about two and one-half years to complete. Most of the change-out was completed by the end of the 2006-2007 heating season, with 1,054 new wood stoves installed, old wood stoves rebuilt, or old wood stoves surrendered. An additional 56 change-outs were accomplished by the end of the 2007-2008 heating season.*





The number of days during the November 1 through February 28/29 heating season with 24-hour average  $\text{PM}_{2.5}$  concentrations above the 35  $\mu\text{g}/\text{m}^3$  standard dropped from six events prior to the change-out to one, one, one, and finally zero in the four heating seasons after the change out program was completed. (Data are not yet available for the 2012-2013 heating season).

The positive impact of the change-out was also seen in the last heating season of the change-out program (2007-2008) when most of the change-outs had already been completed. Only one day had atmospheric  $\text{PM}_{2.5}$  concentrations above the 35  $\mu\text{g}/\text{m}^3$  standard during that heating season as well.



The average  $\text{PM}_{2.5}$  concentration during the November 1 through February 28/29 heating season dropped from 27.0  $\mu\text{g}/\text{m}^3$  to a heating season average of 18.8  $\mu\text{g}/\text{m}^3$  for the four heating seasons (2008-2009, 2009-2010, 2010-2011, 2011-2012) after the change out program. (Data are not yet available for the 2012-2013 heating season.)

In other words, the average heating season  $\text{PM}_{2.5}$  concentration for the four years after the change out was about 70 percent that of the 2004-2005 heating season prior to the start of the change-out or, to put it still another way, a 30 percent drop.

The smaller year-to-year variability in heating season averages seen in the graph is due in large part to the variability in the harshness of the weather from heating season to heating season. Colder weather means more fuel is burned contributing to more pollution and, additionally, temperature inversions are more likely to occur during colder temperature events causing more air stagnation and higher particulate concentrations if all else is equal.



Fine particulate  $\text{PM}_{2.5}$  monitors in Libby.

**Third,** Libby is considered unofficially in attainment with the federal standards for  $\text{PM}_{2.5}$ . The reason it's "unofficial" is that there are still some technical issues with the 2011 monitoring data. Based on 2010-2008 data it would be in attainment. So, bottom line, Libby has reached federal attainments status or is at least very close. It's clear to all involved that this is due primarily to the wood stove change-out program.

**And Finally** – If you go to Libby, drive by a schoolyard and watch the children at play and doing the silly things that children do. Drive by a grocery store or church and watch the senior citizens getting out of their cars.

The Hearth Industry has helped this community both measurably and, more importantly, immeasurably.

## PERSPECTIVE

**F**ine respirable particles or  $\text{PM}_{2.5}$  are particles with aerodynamic diameters less than 2.5 microns ( $\mu$ ) and their concentration in the air are reported in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). A micron is also known as a micrometer and is equal to one millionth of a meter or 0.00004 inches. A microgram is equal to one millionth of a gram or 0.000000035 ounces. A cubic meter is 1.3 cubic yards. The 12  $\mu\text{g}/\text{m}^3$   $\text{PM}_{2.5}$  annual standard is equivalent to 0.0000016 ounces of  $\text{PM}_{2.5}$  in a standard five cubic yard dump truck.

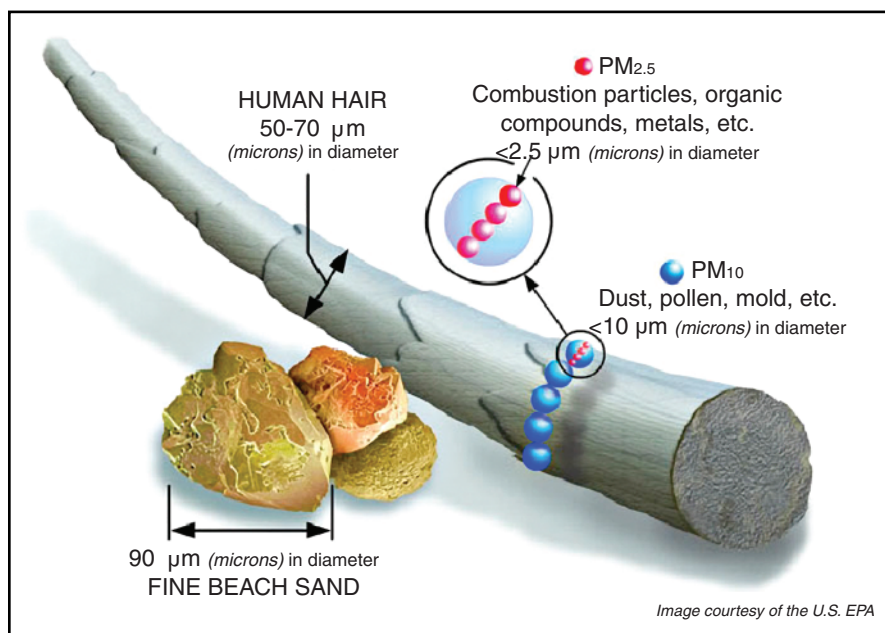


Illustration showing relative size of PM<sub>2.5</sub> particles.

### Libby Annual Averages, Heating Season Averages, Maximum 24-Hour Values, and 98th Percentile Values

Year*	Heating Season (Nov. 1-Feb. 28/29)	Average PM <sub>2.5</sub> (µg/m <sup>3</sup> )	Max. 24-hr PM <sub>2.5</sub> Value (µg/m <sup>3</sup> )	98th Percentile Value (µg/m <sup>3</sup> )
2003		15.6	47	42.5
	2003-2004	27.3	42.5 (12/17/03)	
2004		14.0	39.7	37.7
	2004-2005	27.0	75.3 (1/19/05)	
2005		15.8	75.3	51.1
	2005-2006	26.0	51.1 (11/3/05)	
2006		15.2	43.9	40.5
	2006-2007	22.0	41.2 (11/1/06)	
2007		13.0	34.5	32.2
	2007-2008	22.5	42.3 (1/4/08)	
2008		12.9	42.3	30.5
	2008-2009	20.3	40.1 (1/7/09)	
2009		10.7	40.1	31.4
	2009-2010	18.8	37.3 (1/14/10)	
2010		11.3	37.3	31.6
	2010-2011	16.4	35.9 (1/7/11)	
2011		12.0†	35.9	29.8†
	2011-2012	24.1	32.2 (1/1/12)	
Standard		15/12 µg/m <sup>3</sup> (Annual)**	65/35 µg/m <sup>3</sup> (24 hr, 98th percentile)***	
2008-2010 Annual Libby Design Value		11.7 µg/m <sup>3</sup> (11.4 µg/m <sup>3</sup> )§	31 µg/m <sup>3</sup>	

\* Source: U.S. EPA Air Quality System Preliminary DESIGN Value Report dated Feb. 20, 2013

\*\* Average PM<sub>2.5</sub> annual standard was reduced from 15 to 12 µg/m<sup>3</sup> in December 2012

\*\*\* Maximum 24-hour PM<sub>2.5</sub> standard was reduced from 65 to 35 µg/m<sup>3</sup> in October 2006

† Annual values currently do not meet EPA completeness criteria.

§ Design value provided by Montana DEQ

## DETAILS

They say the devil is in the details. Well, there are a lot of details in evaluating Libby's air quality and the impact of the change-out. For example:

- (1) The average of PM<sub>2.5</sub> during the calendar year, not the heating season, is used to determine compliance with the long-term annual National Air Quality Standard (NAAQS) and, of course, residential wood combustion does not contribute to air pollutant levels outside of the heating season.
- (2) The 98<sup>th</sup> percentile and not the maximum 24-hour value determines compliance with the short-term 24-hour (NAAQS), i.e., monitoring air pollutant concentrations every three days yields 122 samples per year whereas the top two values "don't count."
- (3) The U.S. EPA lowered both the 24-hour and the annual average standards over the course of the time period being reviewed here.
- (4) The PM<sub>2.5</sub> monitor was changed from once every three days to continuous on Nov. 10, 2011.
- (5) The 2011 data has not been accepted yet by the U.S. EPA.
- (6) Design values, which are primarily (with other considerations) averages of the most current three years of data, are used to determine federal air quality attainment status not just the data from the most recent year.
- (7) Confounding the identification of the impact that the wood stove change-out program alone has had on air quality has been the issuance of numerous air quality advisories and three air quality alerts by the Lincoln County Environmental Health Department since December 2008.

Air quality advisories are a warning that local air quality is approaching alert levels and ask wood-burners voluntarily to use an alternate heating system. Air quality alerts are issued when air quality is deemed poor by several criteria and, with the exception of pellet stoves, the use of wood-burning appliances are banned.

## Comments from Local Residents



**Kendra Lind, Assistant Sanitarian**  
**Lincoln County Environmental Health Department**  
**Libby, Montana**

“Years ago we were only dealing with PM<sub>10</sub>, which was a new fledgling wood stove control program. The original regulations dealt with which types of stoves could be used, opacity limits, huge changes from never making the annual or 24-hour average requirements for PM<sub>10</sub>, to bringing that into line within a couple of years. Then when the 2.5 regulations came into effect, that prompted even more stringent regulations.

“Without the wood stove change-out program there would have been a huge number of people who would no longer have had the ability to utilize wood, a renewable resource, to provide some or all of their home heating.

“That’s because of the economic climate in Libby. By the time all of this transpired, the mining industry was shut down, and the timber industry in Libby was pretty well shut down. The economy was hurting then and it is even worse now.

“Going to only certified stoves has made a great difference, but there is always a caveat. We had to educate the people on how to burn. Having a certified stove doesn’t mean that it operates itself. Occasionally there had to be enforcement.

“But the regulators continue ratcheting down the requirements. For us, it’s reduction in emissions as necessary. We really look at keeping tabs on what’s going on with meteorology, with our actual particulate levels, with our forecasts and try to maintain and still not overdo and burden folks if we don’t have to. We need to do our job and protect public health and keep the air quality as good as we can. And we don’t want to abandon the ability to utilize wood, a renewable resource, as an energy and heating source.

“Our air is very much improved; there’s been an extreme improvement over what we had. There was a marked improvement as we moved through our PM<sub>10</sub> phase, and additional improvement in the PM<sub>2.5</sub> era partly due to more stringent regulations and partly due to the change-out so that everybody in this area is burning a certified stove.

“Do we still have overcast days? Sure we do; we live down on the mountain and are very much weather-driven. But overall it’s better air quality.”

**Kathi Hooper, Director**  
**Lincoln County Environmental Health Department**  
**Libby, Montana**



“The air here is visibly cleaner now. We get comments frequently from people, like me, who grew up here; they mention how noticeable the difference is, how much farther you can see and how much cleaner everything smells.

“We still have inversions and we still have a lot of cloudy, gray days, but that’s just winter in Libby. There just isn’t as much smoke. I have heard from the community that they are able to be outside more in the winter. Much of our population has other respiratory problems and poor air quality really does send them inside. I can think of a few people who have asbestosis and are able to be out more often.

“My department is responsible for enforcement of the old stove ban. If we see smoke we knock on the door. We have found very, very few old stoves in the past few years, and none this year. Quite often when we do see smoke it’s from wet firewood. We are also involved in education (about proper burning).”

The Libby success story is widespread now. “I have received calls from people in Alaska, and from the Puget Sound (Washington) area. I’ve talked quite a bit with folks in the Seeley Lake area of Montana.

“Their situation seems to be quite similar to ours where wood smoke is the main source of pollution; they don’t have other industries contributing, and they do have a population that doesn’t really want government involvement or regulations. I think they are facing problems similar to ours.”



**Hoby Rash**  
**Ambient Air Monitoring Supervisor**  
**Montana Department of**  
**Environmental Quality**  
**Helena, Montana**

“Our position right now is that we’re definitely in attainment through 2012. We have to submit a data certification document to EPA by the end of (April) that will include the data on Libby.

“Some principles that we learned in Libby we are trying to apply elsewhere, including here in Helena. We have a PM<sub>2.5</sub> issue here in the wintertime, in our opinion largely due to wood stoves or wood combustion.

“The same is true in the community of Butte, which is perhaps a little worse than Helena in terms of PM<sub>2.5</sub> attainment. We’ve done some studies down there this past winter to just re-cement in people’s minds what is causing it and that it’s wood stove combustion. We compare what transpired in Libby to the dynamics in other mountain valleys around western Montana and definitely see that wood stove change-outs are a huge component of clean air in this terrain in this part of the U. S.

“For instance, as we anticipate trying to address the Butte issue, I think our goal would be a wood stove change-out because we’ve seen such great success in Libby.

“There is another county program going on that we’ve contributed to in Missoula County in a small community called Seeley Lake. The problem up there is exactly the same – very high levels of PM<sub>2.5</sub> in the wintertime attributable to wood combustion. The county has pursued a wood stove change-out program there as well, and they are beginning to see some positive results. So, in a nontechnical perspective but with some technical knowledge included, there is information gathered in Libby that can be used in other areas of the state.”

**Hearth & Home:** *The problem in other areas must be that no one will say, as the Lincoln County Board of Commissioners did, Here’s the date and deadline when old wood stoves cannot be burned anymore. That was possible in Libby because low-income residents were being offered free stoves, and others were receiving a voucher for a very deep discount. That made the change-out more palatable. You’re not going to be able to do that in other areas, are you?*

“No, and that’s really the killer. How do you economically facilitate that change? From a state regulatory perspective, this is so different than how we would typically approach air pollution problems, which are normally associated with large industrial sources. As a condition

of their continuing operation they have to make some changes or updates in order to preserve air quality.

“In this case we’re talking about personal residences; we’re talking about lifestyle changes; we’re talking about their own personal economic well-being and a whole lot of other factors that make this a lot more challenging. In the case of the Missoula County situation I was telling you about, they were able to come up with some money to really help a lot of people. That is a very different dynamic in that tiny little hamlet than what exists in a Butte or Helena, which are much larger communities. In each of those cases there is a much larger valley.



“But I will also say this – in sort of an attending outcome of this whole process we’re learning more about the PM<sub>2.5</sub> in these mountain valleys, and what we have classically really thought of as a pretty ubiquitous pollutant that kind of fills up the bowl. We’re really not convinced that’s the case anymore. It looks like it’s much more neighborhood by neighborhood, block by block, home by home, region by region. It’s kind of a dynamic even in a small little mountain valley.

“So we hope to do more intensive monitoring and even target by neighborhood, maybe older neighborhoods with older wood-burning devices, areas that may be more economically depressed. We wouldn’t try to change out all the stoves in an entire city, but perhaps we could focus in on smaller neighborhoods and regions and come up with a cleaner benefit as a result of that kind of a change-out.

“As we have progressed and built on the data we gathered in Libby, our approach may be a little bit different and, hopefully, more beneficial for everybody as a result.”

**Dr. Jay Maloney**  
**Prompt Care/ER**  
**St. John's Lutheran Hospital**  
**Libby, Montana**



"Has the wood stove change-out caused a decrease in emergency room visits? I would say, yes, but because of our low population of children, though, it's not been near as evident in children as it has been with adults.

"Especially during periods of inversions, now compared to 20 years ago there have been drastic differences as far as the number of people that come in with exacerbation of COPD (chronic obstructive pulmonary disease), pneumonia and asthma. It definitely has been noticed that the area has been cleaner since the wood stove change-out."

**Dr. Brad Black**  
**CEO & Medical Director**  
**Center for Asbestos Related Disease**  
**Libby, Montana**



"The days are so much better here with less particulate in the air, and I know that the stove change-out has contributed to that. The contribution from residential wood-burning was so significant in our community and it clearly improved that. I can't say enough. I think it was a great project and it did very good things for this community and improved the quality of life, particularly for people with lung disease because they still have trouble on days with inversions, but it would be much worse if the air were like it was before the change-out."



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**Tony Berget, County Commissioner**  
**Former Mayor of Libby during Change-out**

**Bill Bischoff**  
**Executive Assistant**  
**Lincoln County Commissioners**

*Tony Berget.*

**Tony Berget:** "When I was a young kid I can remember the snow around town being black. There was just enough fallout from all the wood smoke and from what was happening at the (lumber) mill. It was black. My brother and I often both seemed to have a touch of asthma. There were a lot of times where the town was really smogged in, but since the change-out I can say it's rare that we have a situation where the town seems dirty. The snow is no longer black. We now have white snow."

"So between the change-out and some of the things they did at the mill, the efforts to clean the air have made a significant difference. This has become a beautiful little town. It's a better place to live."

**Bill Bischoff:** "I think Tony is exactly right. Before we had the wood stove change-out program, you could go out and look at your car in the morning and there would be a layer of ash all over both the car and the snow. One of the things we all notice now, when you get up in the morning on a cool fall or winter morning and you step outside, you don't smell the wood smoke, you notice the sun in the valley."

"I think (convincing people to swap out their old wood stove for a new one) was probably hard. Of course, we are from Montana and people are very independent up here. But we had a lot of meetings and tried to educate the public. It was a huge educational process. But I can tell you this from experience, it would not have happened the way it did without help from you guys, without your support to replace the stoves and do it free or at cost. Because people couldn't afford it, number one, and they would have fought all the way to maintain their old wood stoves without a replacement program."

**Berget:** "I agree with that because, as mayor of the town at the time, I can remember people screaming and hollering a little bit, but then they realized, Well, we're getting a free wood stove, one of the EPA-certified ones."

**Bischoff:** "Another thing people found out was that the newer wood stoves are more efficient so it didn't cost as much if you purchase your wood, or if you had your own wood, it didn't take as much. People found out quickly that it didn't take as much wood."

**Berget:** "I didn't get one through the program, but the one I have I love because it's so much better than the one I had. With that one I never had a fire by morning, and with an EPA-certified stove I can turn it way down and still have hot coals in the morning."

"You know, it's been nice. Since the end of the change-out there have been a couple of times when somebody had a problem and we still had some dollars left from the program to help them out. The stoves are pretty much gone, but the program has been good. Thank you for putting that together."



## HPBA's Involvement

**Jack Goldman**  
**President/CEO**  
**Hearth, Patio & Barbecue Association**



"There are not a lot of things you do in your career where you can look back and say without any hesitation, 'This really was a good thing,' without anything to qualify what you're saying. The people in the hearth industry who worked on this project should feel that way about this project in

Libby. It's one of the few times in life when you can look back and say, 'We really helped. We really did something to help people who needed help.'

"The industry mobilized and raised well over a million dollars in stoves at their value at that time. Plus there were many additional financial contributions from all segments in the industry. It made me very proud to be part of this industry because we did get money from a lot of sources.

"We also got an earmark from Congress from the

U.S. EPA's budget for \$1 million, and the HPBA probably invested more than \$250,000 in staff time and other expenses such as travel, setting up meetings and other things to get the project going. It's just incredible that we can look back and say, virtually every old wood stove in the area was changed over in fewer than two years.

"What helped enormously was when the Lincoln County Board of Commissioners, I think they were called, actually outlawed the use of old wood stoves after a certain date, which was during the period in which we were doing the change-out. That was just a great way to get people's attention and to focus them on the fact that either they could get a free stove if they were in the lower-income bracket, or at least a huge leg up on having the pay for a new unit if they were not.


"The other thing that was good to see was that, while industry members spent every minute of every day competing with each other, everyone was willing to put that aside and cooperate to get the Libby project completed. That showed that the moral fiber of the people in the industry is very strong."

**Matt Bunk**  
**Publisher/  
Advertising Manager**  
**The Western News**  
**Libby, Montana**



Twelve years ago Matt Bunk lived in Libby and worked for *The Western News* as a reporter. He left the area

for a while, but returned about six months ago to take over as publisher.

"When I was first here," he says, "there was always a bit of a haze hanging over our town. Now that I'm back, I've looked at the monitoring data and walked around town, and that haze is gone. Twelve years ago the air was pretty bad in Libby, and now it's pretty good." 



\*first opening order



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