Consumer Opinion Forum, Survey #3

Clothes Dryer Maintenance

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Rana Balci-Sinha, Ph.D.
Division of Human Factors
Directorate for Engineering Sciences
U.S. Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814
rbalcisinha@cpsc.gov

Contents

I. Introduction

A. What is the Consumer Opinion Forum?

The Consumer Opinion Forum is an internet-based survey that is available for voluntary participation by interested consumers 18 years of age and older through the U.S. Consumer Product Safety Commission (CPSC) website. The Forum is managed by the staff of the CPSC Division of Human Factors and is used to assist in making more informed judgments on consumer behavior, perceptions, and attitudes. The Forum periodically posts surveys to solicit information of this type from those who have registered to participate. Because this respondent population is a convenience sample rather than a random sample, the survey results may not be representative of the general population and therefore, results cannot be used to make generalizations and statistical inferences about the entire population. Nevertheless, the results do provide preliminary data on consumer behavior that is otherwise not available. Moreover, because voluntary registration via the CPSC website is the only method by which consumers can participate in the survey, the staff believes that this respondent population is more likely to show an interest in product safety and to be more aware of safety issues than the general public. Unsafe behaviors or low hazard perceptions among this population would most likely point to problems that would be even more prevalent among the general consumer population.

B. Clothes Dryer Forum Survey

On October 5, 2009, the Human Factors staff began distributing e-mails (Appendix A) to all registered participants, inviting them to complete a survey about their experiences with clothes dryers and clothes dryer maintenance. A printout of the survey appears in Appendix B of this report. At the time invitations were distributed, 2,381 people had registered to participate in the forum. The staff distributed invitations to all registered participants and received 217 automated "undeliverable" or similar e-mail responses for reasons such as those e-mail addresses were no longer valid. The survey closed on November 2, 2009, with 358 respondents having provided responses. This number corresponds to a response rate of 16.5 percent[1]. Among those who completed the survey, the mean and median completion times were 9 minutes and 5 minutes, respectively. Eighty-five percent of respondents who completed the survey did so in less than 10 minutes.

The purpose of this Consumer Opinion Forum survey was to gather information from participants regarding their knowledge and use of clothes dryers. The survey was not intended to identify the causes of clothes dryer related fires. Readers who are interested in the topic can refer to "Analysis of Industry Data on Clothes Dryer Fire Incidents" published by Association of Home Appliance Manufacturers (AHAM, 2002).

[1] If one considers only those e-mail addresses that are likely to be valid, the response rate is 358 / (2381-217) or about 16.5 percent.

II. Respondent Population

Survey respondents ranged from 19 to 78 years old at the time of the survey, with a mean and median age of 46 years and a standard deviation of 12 years. Approximately 60% of all respondents were female; 40% were male. Figure 1 shows the age and gender distribution.

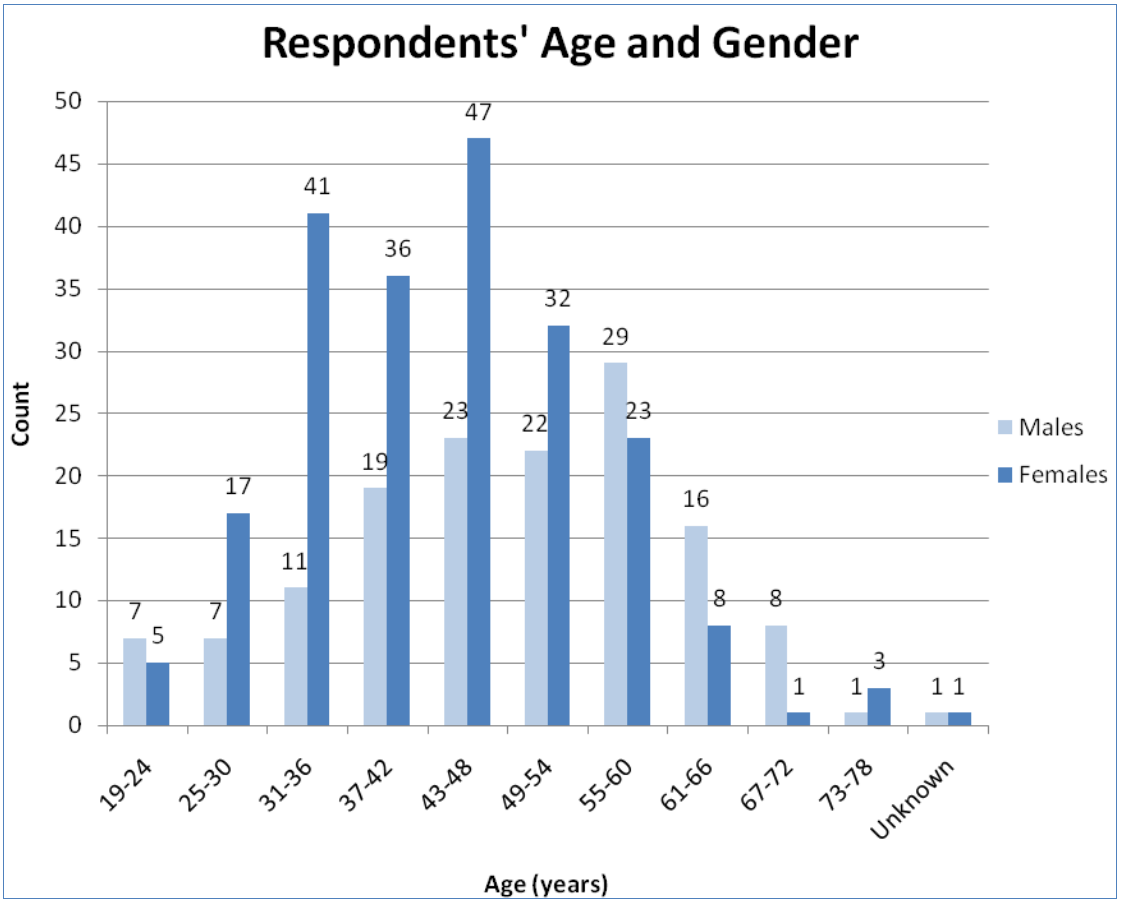

Figure 1. Age and gender distribution of the participants

Twenty-nine percent of respondents reported that they have no children, followed by 19% with 1 child, 32% with 2 children, 13% with 3 children, and 6% with 4 or more children. These ratios are similar to those of 15-44 year-old American family householders with no children at 25%, 1 child at 28%, 2 children at 30%, 3 children at 13%, and 5% at 4 or more children based on America's Families and Living Arrangements: 2009 published by U.S. Census Bureau (U.S. Census Bureau, 2010).

III. Clothes Dryer Type and Setup

Survey respondents were asked about the type of their clothes dryer, its ventilation, and type, length, and number of bends/elbows of the ducts. Twelve of the 358 respondents reported that they did not own or regularly use a tumbler type clothes dryer and exited the survey. The percentages from this point on are calculated using the remaining 346 responses. Approximately 41% of the respondents (142) reported that their clothes dryers are less than 5 years old as shown in Table 1:

Table 1. Age of Clothes Dryers reported by Consumers

Age of the Clothes Dryer	Count	Percentage
Less than 5 years old (made after 2004)	142	41%
5 to 10 years old (made between 1999 and 2004)	103	30%
11 to 15 years old (made between 1994 and 1998)	45	13%
More than 15 years old (made before 1994)	36	10%
I don't know	19	5%
No Answer Entered	1	0.3%
Total	346	100%

Approximately 74% of the respondents (257) indicated that they use electric clothes dryers; 22% (75) indicated that they use gas clothes dryers; two respondents indicated that they use LP (Propane) clothes dryers. Eleven respondents indicated that they do not know the type, and one respondent did not answer. AHAM's statistics for the shipment of electric versus gas clothes dryers from 1999 to 2009 show an average of 79% electric units, which is similar to the rate reported by respondents (AHAM, 2010). Close to 93 percent of the respondents (320) reported that their clothes dryers are vented to the outside. Sixteen respondents reported not having outside ventilation, and nine of them reported having some type of lint-trapping device inside the home. Among the dryers that were vented to the outside, the type of venting material is shown in Table 2.

Table 2. Duct Material for Clothes Dryers Vented to the Outside

Type of Duct connected to the Clothes Dryer	Count	%
Flexible accordion-type foil only	134	42
Flexible accordion-type white plastic only	52	16
Flexible metal only	40	13
Rigid metal only	28	9
Rigid metal; Flexible accordion-type foil	16	5
I don't know	12	4
[No Answer Entered]	8	3
Rigid metal; Flexible metal	9	3
Flexible metal; Flexible accordion-type foil	7	2
Rigid metal; Flexible accordion-type white plastic	5	2
Rigid metal; Flexible metal; Flexible accordion-type foil	4	1
Flexible accordion-type foil; Flexible accordion-type white plastic	3	1
Flexible accordion-type foil to rigid metal to the roof	1	0.3
PVC only	1	0.3
Total	320	100

Figure 2 shows the distribution of the duct length stated by the respondents (13 of 320 respondents did not give an answer). More than half of the ducts are reported to have a length of 4 feet or less from the clothes dryer to the exterior wall (as described in the survey with text and pictures) while the average duct length was 5.6 feet. About 80% of respondents reported two or fewer elbows or bends from the clothes dryer to the exterior wall through which the duct passes (Table 3).

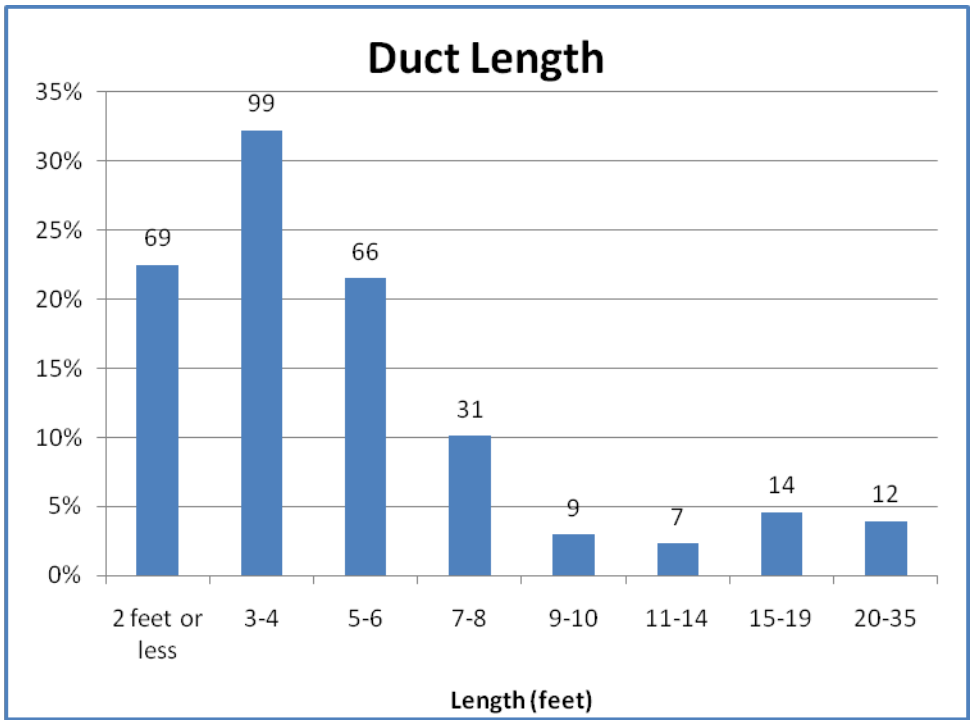

Figure 2. Duct lengths specified by respondents

Table 3. Number of elbows or bends in the dryer duct

Number of Elbows/Bends in the Duct	Count
0	20
1	55
2	186
3	32
4	8
5	1
6	2
7	1
10	1
25	1
[No Answer Entered]	13
Grand Total	320

IV. Operating Problems with Clothes Dryers

Survey respondents were asked whether they ever had experienced any operating problems with their clothes dryers. Approximately 30% of all respondents reported having an operating problem with their clothes dryers. The top two reported problems were the lack of or insufficient heat to dry clothes (18%) followed by lint accumulation (17%) (Figure 3). Among the 19 reports of lint accumulation, 11 respondents indicated the location as vent or duct, two indicated the location as exhaust exit, one noted underneath the unit and another noted in hard to reach areas.

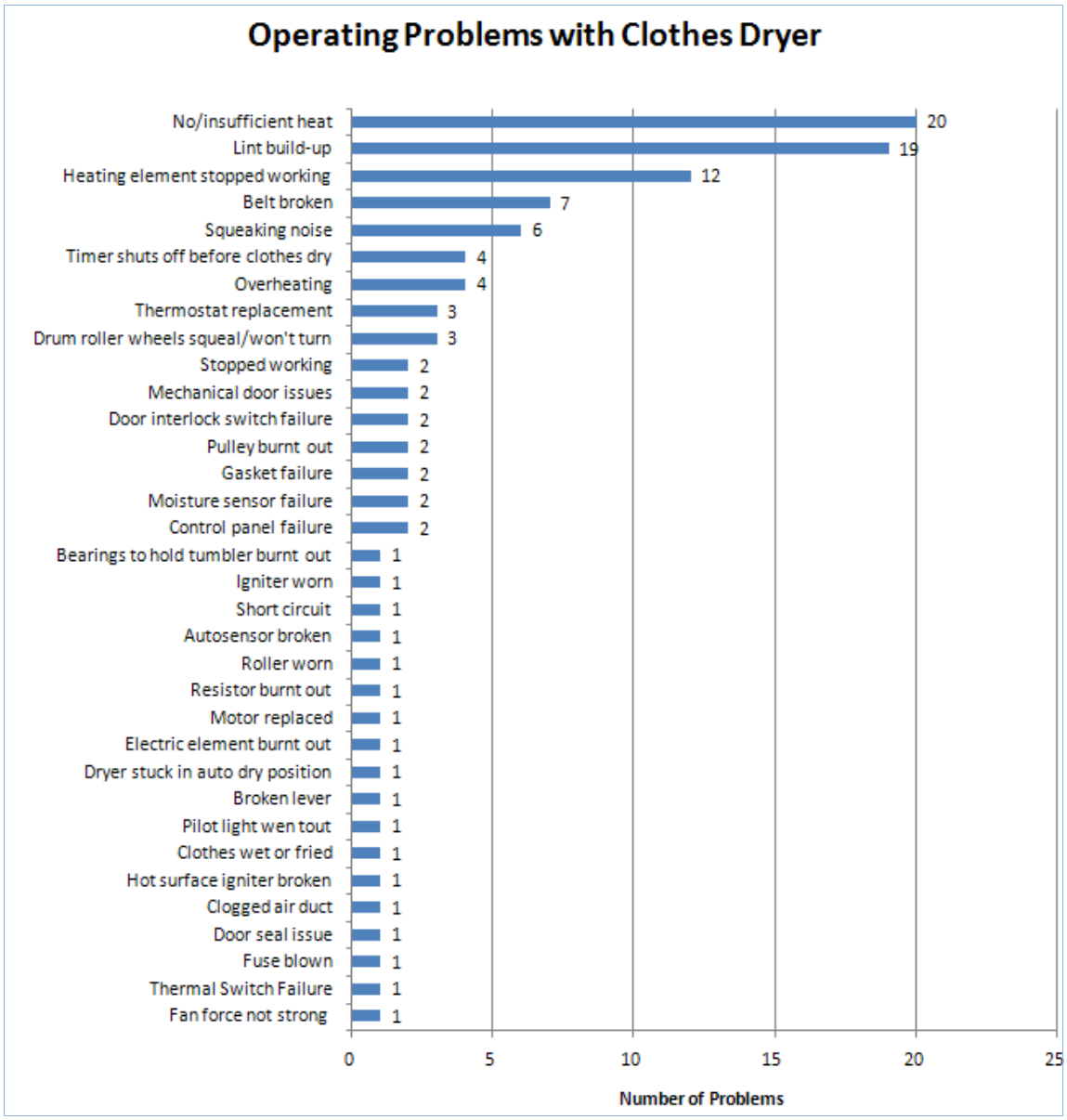

Figure 3. Operating problems reported

V. Clothes Dryer Use

Survey respondents were asked how frequently they used their clothes dryers. On average, consumers reported drying approximately 6 loads of clothes per week. Approximately 42% of respondents indicated that they dry 7 or more loads of laundry every week while 44% of the respondents reported drying 3-6 loads per week, and 14% reported drying less than 3 loads a week (Figure 4).

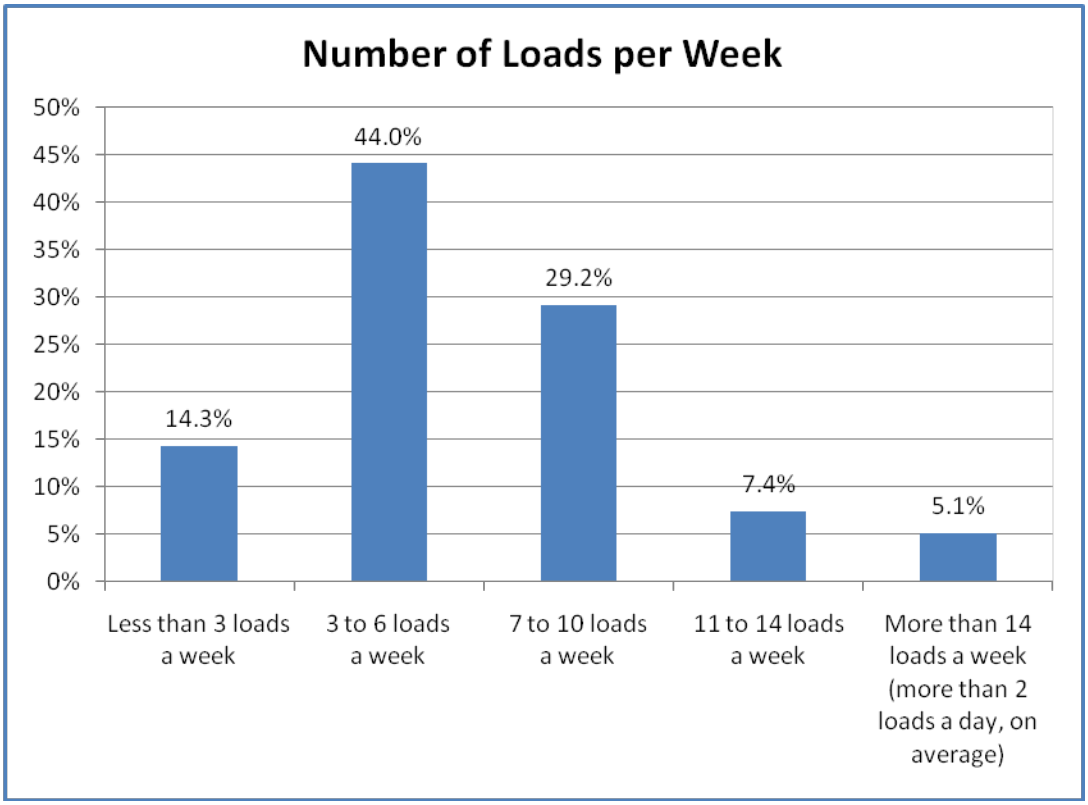

Figure 4. Number of loads dried in the clothes dryer each week

As expected, household size and the frequency of clothes dryer uses per week are statistically related ($\chi^2(20, N=336)=82.11, p<0.0001$). Figure 5 shows the distribution of the number of loads of laundry done by respondents categorized by the number of children they have.

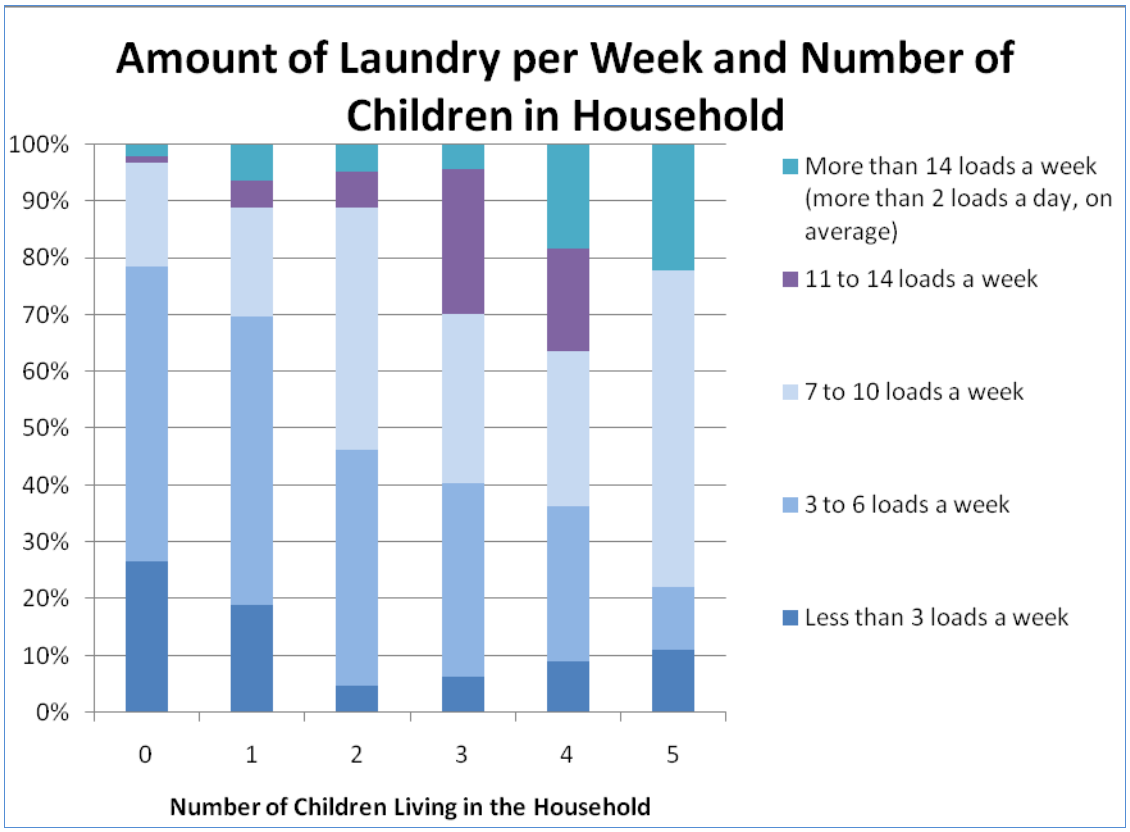

Figure 5. Number of loads dried in the clothes dryer each week and the number of children in household

VI. Clothes Dryer Maintenance

Survey respondents were asked about their actions in various maintenance areas including the lint filter, the space under the lint filter, the space inside the dryer cabinet between the rotating drum and inside surface of the dryer cabinet; interior of the dryer duct along its full length; and, finally, the exhaust exit. Following are the results.

A. Cleaning the Lint Filter:

Approximately 96% of all respondents reported cleaning their clothes dryer lint filter at some time. Among those, 68% of respondents stated that they clean the lint filter once every load (Figure 6).

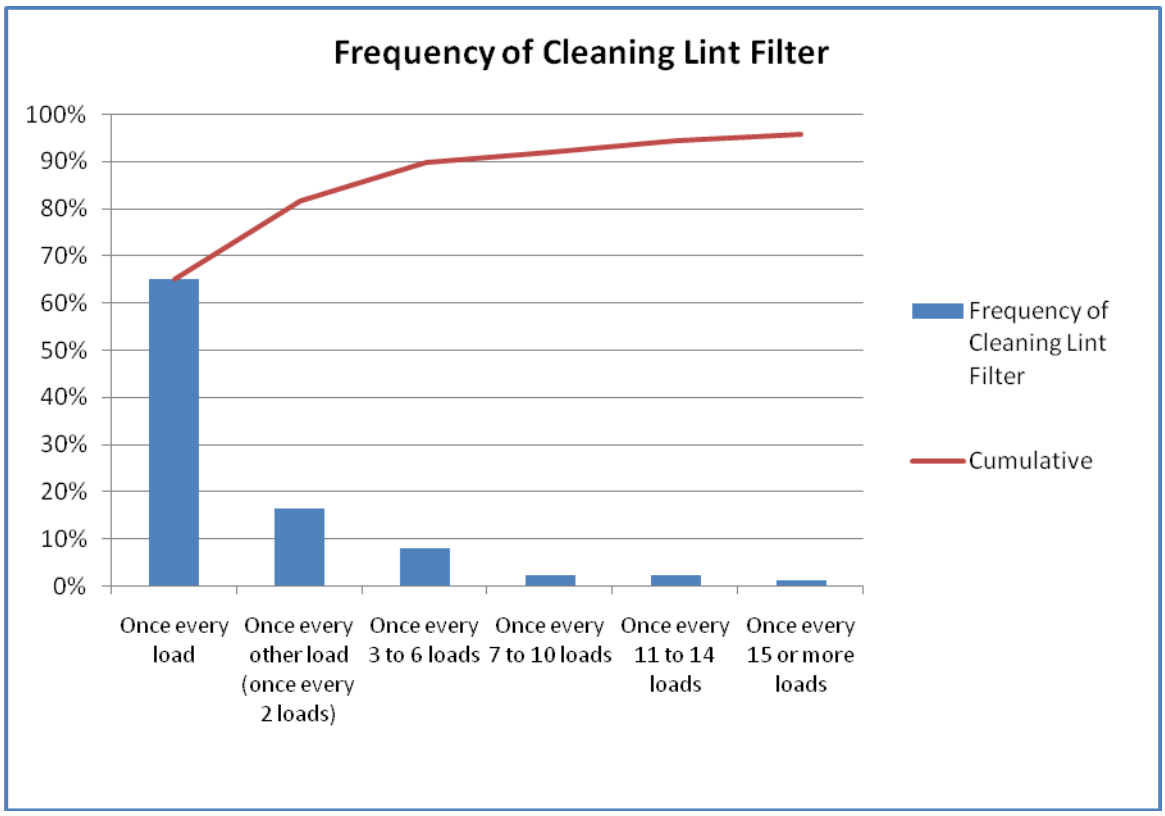

Figure 6. Frequency of cleaning the lint filter among all respondents

B. Other Maintenance Activities:

Approximately 71% of the respondents indicated that they checked exhaust exits, 62% cleaned the area under the lint filter, 38% cleaned the dryer ducts, and 20% cleaned inside the dryer cabinet (Figures 7 – 10). Only 20% of all respondents reported having performed every one of the maintenance activities at some time. Eight consumers who reported that they cleaned inside the dryer cabinet claimed to have done so because a repair was being performed on the dryer. The same is true of nine consumers who reported having the dryer duct cleaned two to three years ago when a repair was performed on or in the surrounding area of the dryer or duct.

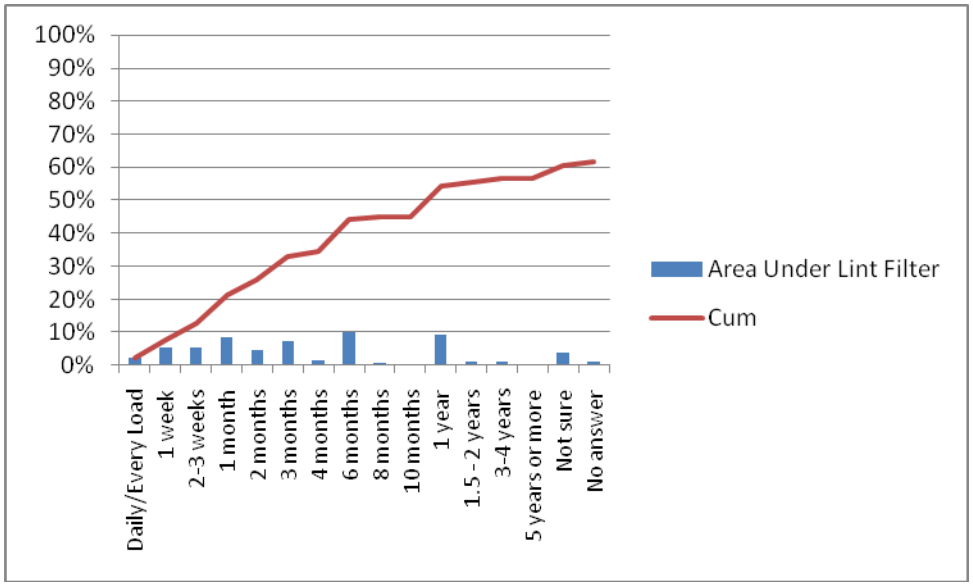

Figure 7. Frequency of cleaning the area under the lint filter

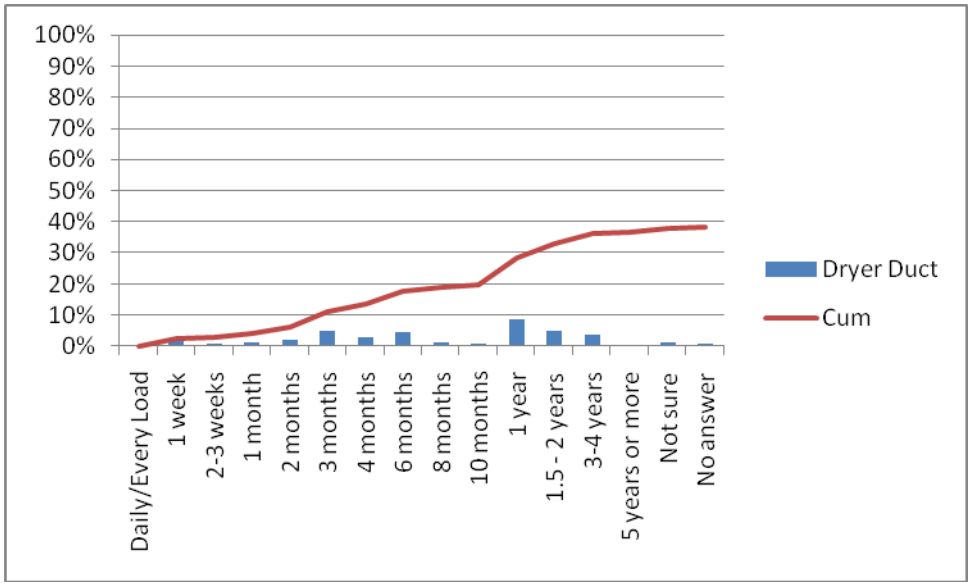

Figure 8. Frequency of cleaning the dryer duct

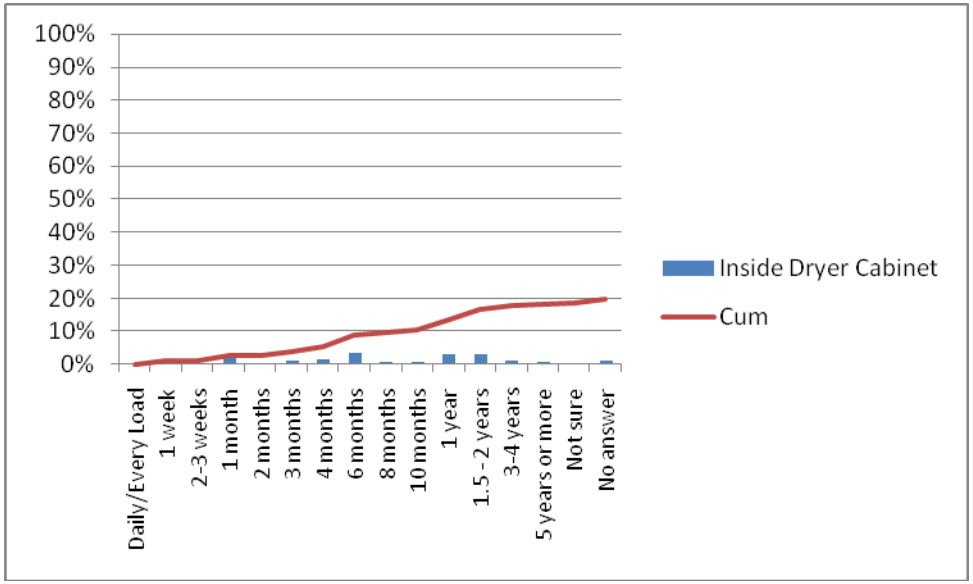

Figure 9. Frequency of cleaning the dryer cabinet

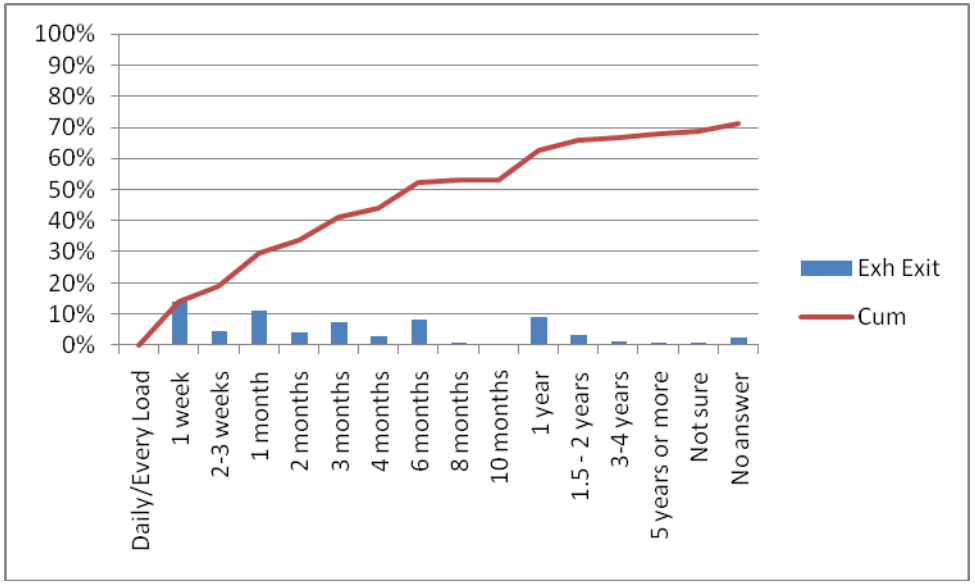

Figure 10. Frequency of checking the exhaust exit for blockages

C. Perceived Benefits of Maintenance Activities:

All respondents, regardless of their prior responses about their maintenance activities, were asked to respond to a question about the benefits they associated with various maintenance tasks. Responses are summarized below:

Benefits of Cleaning the Lint Filter:

Approximately 96% of the respondents reported cleaning the lint filter at some point and virtually all respondents believe there are benefits to cleaning the lint filter. Reduced fire hazards (55%), increased operating and energy efficiencies (36%), better and quicker drying (31%), and improved airflow (23%) were the top reasons reported.

Benefits of Cleaning the Dryer Cabinet:

While only 20% of respondents cleaned inside the dryer cabinet, almost half of all respondents believe there are benefits associated with it. Sixty-three percent of those who believe there are benefits (31% of all respondents) indicated that this maintenance activity reduces the fire hazard. Association of a fire hazard with cleaning the dryer cabinet is equal to all the other benefits combined such as increased efficiency and better drying.

Benefits of Cleaning the Dryer Duct:

Although 38% of all respondents cleaned the dryer duct, almost 80% of all respondents believe that there are benefits to this activity. The most frequently reported reason is to reduce fire hazards (52%) followed by improved air flow (21%) and increased operating and energy efficiencies (19%).

VII. Clothes Dryer Related Fires

Eleven of the respondents reported having experienced a fire that was determined to be related to a clothes dryer. Table 4 shows the identified source of each fire when specified. Eight of the 11 respondents who reported having clothes dryer related fires also reported that lint was specifically identified as the first item that caught fire.

Table 4. Clothes dryer related fires experienced by the respondents

Specific part or location that was identified as the source of the fire
Control panel
Heater coil
Rotating drum
Lint trap
Dryer duct/vent
Lint that had collected on the components beneath and up in the drum of the dryer
Heater coil
Electrical system
Heater coil burned the surrounding dust and lint
No Answer Entered
No Answer Entered

VIII. Discussion / Conclusion

An annual average of 6,900 clothes dryer fires in residential buildings caused an average of fewer than five deaths, 220 injuries, and $91.0 million in property damage per year between 2005 and 2007 (Miller et.al., 2010). The leading factor contributing to ignition is identified as operational deficiency – specifically "failure to clean" (USFA, 2007).

CPSC staff conducted an internet-based survey to gather information from consumers regarding how they set-up, use, and maintain their clothes dryers and their beliefs on benefits of performing maintenance, primarily cleaning activities. The survey was completed by 358 respondents. Approximately 93% of the respondents reported having clothes dryers that are vented to the outside and using an average of 5.6-foot long ducting that runs from the clothes dryer to the wall. Most of them reported using flexible ducting material, which can trap the lint easily and is more susceptible to kinks and crushing, which can reduce airflow (U.S. Consumer Product Safety Commission, 2003). Most manufacturers recommend the use of a rigid or corrugated semi-rigid metal duct (CPSC, 2003).

On average, consumers reported drying approximately six loads of clothes per week. The majority of the respondents (96%) reported that they clean their lint filter, while 68% of those respondents reported cleaning at every load as recommended by manufacturers. Fifty-five percent of the respondents indicated that they believe that cleaning the lint filter reduces the fire hazard. As an additional maintenance procedure, manufacturers usually recommend the dryer cabinet and exhaust vent be cleaned by qualified people or professionals once a year or every two years or more frequently depending on the frequency of clothes dryer use. The Association of Home Appliance Manufacturers (AHAM) recommends periodic cleaning of those areas primarily to keep sufficient airflow (AHAM, http://www.aham.org). The respondents were asked to indicate their maintenance activities including cleaning inside the dryer cabinet, the exhaust vent, and the area under the lint filter, and checking exhaust exits for blockages. Twenty percent of all respondents reported having performed all of these five maintenance tasks. Regardless of their maintenance behavior, all respondents were asked to indicate whether they believed that there are benefits associated with the maintenance activity. The top reported benefit was fire hazard reduction. Other benefits specified by the respondents included improved operational and energy efficiency, improved airflow, and increased longevity of the dryer among others; however, all of these factors have lower rates compared with the fire hazard. Twenty percent of the survey respondents reported cleaning inside the dryer cabinet while 31% of respondents reported fire hazard reduction as a benefit of dryer cabinet cleaning. The difficulty of performing a maintenance task may have an influence on whether consumers will conform to it. The two maintenance activities that more than 70% of respondents reported having performed are also the two easiest: cleaning the lint filter (96%) and checking the exhaust exit for blockage (71%). Cleaning the dryer duct is

relatively more difficult to perform compared with cleaning the lint filter. Although the percentage of respondents who believe there are benefits to fire hazard reduction by cleaning the dryer duct and cleaning the lint filter are roughly the same (52% versus 55%), only 38% of respondents reported having cleaned the dryer duct as opposed to 96% of respondents who reported cleaning the lint filter. Manufacturers usually recommend that professionals or qualified people clean the dryer cabinet and exhaust duct. A service call to clean the accumulated lint within the dryer can be costly and inconvenient to the consumer, and therefore the consumer may overlook performing this maintenance task until there is an operating problem with the dryer, which may lead to a higher risk of fire. To enhance maintainability, future clothes dryers could incorporate more user-friendly designs that allow consumers to easily and safely remove the accumulated lint within the cabinet areas.

IX. References

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Appendix A- Invitation e-mail

You are invited to complete a new survey that has been posted in the U.S. Consumer Product Safety Commission's (CPSC's) Consumer Opinion Forum. This survey will ask you about on your experiences with clothes dryers.

To take the survey, please click on the link below and log into the Forum using your registered e-mail address and password. If you cannot remember your password, simply click the link below and click "Forgot your password?" on the Forum's login page. Then follow the instructions to have your password e-mailed to you.

https://www.cpsc.gov/cgibin/cof/UserTakeSurvey.aspx?EID=981B4m2B038B2K8m6B39mB215BJ16

The survey will expire on October 30, 2009. If you would like to participate, please do so before that date. If you prefer not to participate, you can simply ignore this e-mail.

Thank you.

CPSC Consumer Opinion Forum

Appendix B- Survey

Survey 03 - Clothes Dryers

Page 1

Thank you for choosing to participate in this survey, which will ask you about your experiences with clothes dryers. This survey should take less than 15 minutes. If you have any comments concerning the accuracy of this time estimate or have any suggestions for reducing it, please send them to us at cof@cpsc.gov. To avoid influencing other people's responses, please do not discuss this survey with anyone until after October 30.

All questions marked with an asterisk (*) are required. To navigate through the survey, please use the buttons provided on the survey pages. Do not use your browser's Back and Forward buttons. Clicking CANCEL will close the survey, but you can log back into the Forum anytime before October 30 to complete it.

To begin, please click NEXT.

Page 2

1. Most clothes dryers use a rotating drum to tumble the clothes while hot air is blown through them. Do you use a tumbler-type clothes dryer in your home?*
   - ◯ Yes
   - ◯ No

Page 3

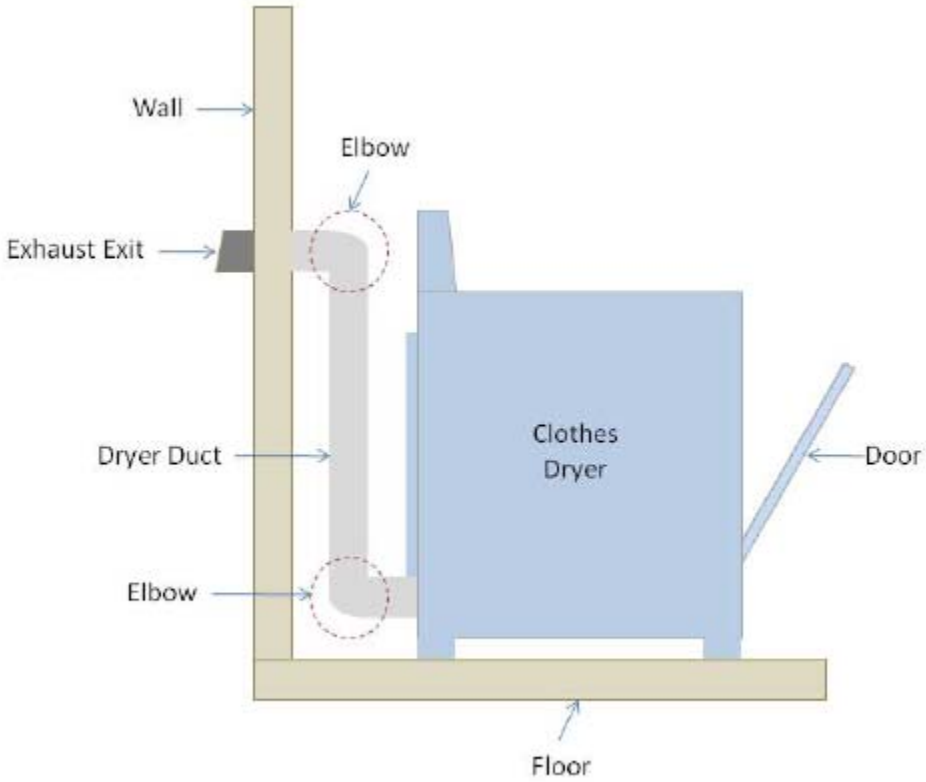
2. Most clothes dryers are classified as electric or gas, meaning that they use either electric or gas-fueled heaters to heat the air in the dryer, but there are other types. What type of clothes dryer do you use in your home?
   Choose one.
   - ◯ Electric
   - ◯ Gas (Natural Gas)
   - ◯ LP (Propane)
   - ◯ I don't know
   - ◯ Other, please specify

3. How old is the clothes dryer?
   - ◯ More than 15 years old (made before 1994)
   - ◯ 11 to 15 years old (made between 1994 and 1998)

- ◯ 5 to 10 years old (made between 1999 and 2004)
- ◯ Less than 5 years old (made after 2004)
- ◯ I don't know

Page 4

The drawing below shows an example of how a clothes dryer might be vented to the outside using a dryer duct. In this example, a dryer duct exits the back of the dryer and passes through an exterior wall to the outside. The dryer duct might have several bends, or elbows, before passing through the wall.



4. Is your clothes dryer vented to the outside?*
   - ◯ Yes
   - ◯ No
   - ◯ I don't know

Page 5

5. Is your dryer connected to an indoor lint trap, indoor dryer vent, or similar lint-trapping device intended to filter lint from the dryer exhaust before it enters the house?

- ○ Yes
- ○ No
- ○ I don't know

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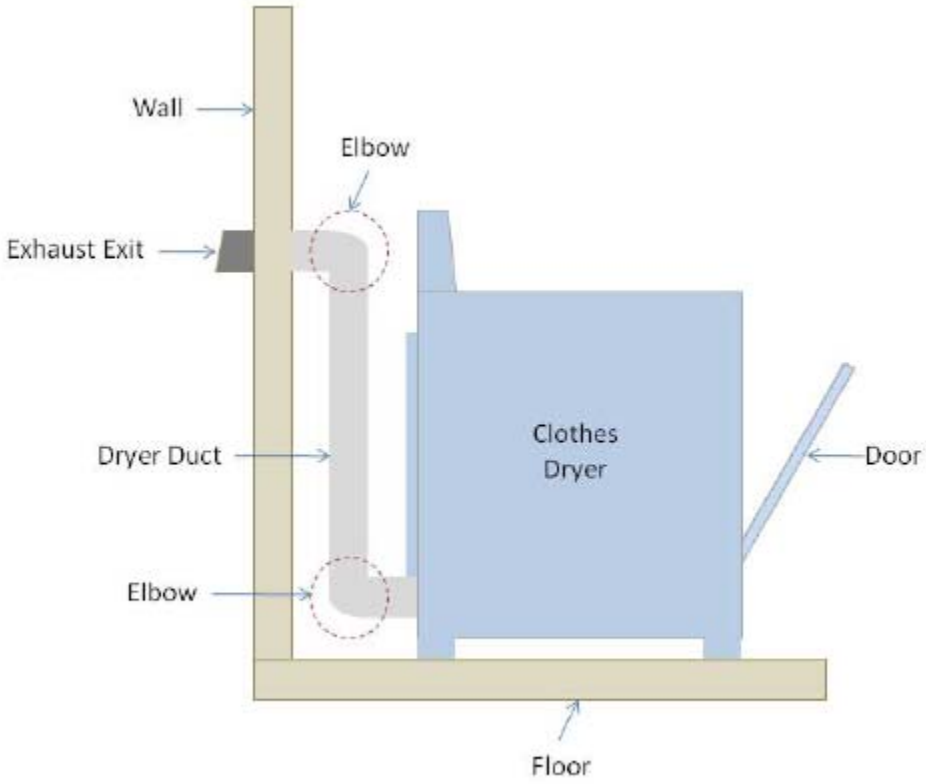

6. What type of duct is connected to your dryer?
Some dryer ducts may be made from multiple materials. Check all that apply.

- ☐ Rigid metal
- ☐ Flexible metal
- ☐ Flexible accordian-type foil
- ☐ Flexible accordian-type white plastic
- ☐ I don't know
- ☐ Other, please specify

7. About how long, in feet, is the dryer duct that runs from the clothes dryer to the wall? If you do not know the exact length, please provide your best guess.
The value must be greater than or equal to 0.

8. About how many elbows, or bends, are in your dryer duct before it passes through the exterior wall? If you do not know the exact number, please provide your best guess.
The value must be greater than or equal to 0.

Page 7

9. Have you ever had an operating problem with your clothes dryer?*
   - ○ Yes
   - ○ No
   - ○ I don't know

Page 8

10. Please list the problem(s) you have had with the clothes dryer.

Page 9

11. On average, how many loads of laundry do you dry in your clothes dryer each week?
   - ○ Less than 3 loads a week
   - ○ 3 to 6 loads a week
   - ○ 7 to 10 loads a week

- 11 to 14 loads a week
- More than 14 loads a week (more than 2 loads a day, on average)

12. Have you ever cleaned the lint filter in your clothes dryer?*

- Yes
- No

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13. On average, how often do you clean your lint filter?

- Once every 15 or more loads
- Once every 11 to 14 loads
- Once every 7 to 10 loads
- Once every 3 to 6 loads
- Once every other load (once every 2 loads)
- Once every load

Page 11

14. Do you think there are any benefits to cleaning the lint filter?*

- Yes
- No
- I don't know

Page 12

15. What are the benefits of cleaning the lint filter? In other words, why do you think the lint filter should be cleaned?

Page 13

16. Have you ever removed the lint filter and cleaned the area below using a brush, vacuum cleaner, or similar tool?*

- Yes
- No
- I don't know

Page 14

17. About how long ago was the last time you cleaned the area under the lint filter?

Page 15

18. Have you or anyone else ever cleaned the space inside your dryer cabinet between the rotating drum and the inside surface of the dryer cabinet? This area is not visible when you open the dryer door.*

- Yes
- No
- I don't know

Page 16

19. About how long ago was the last time you or someone else cleaned the space inside your dryer cabinet?

Page 17

20. Do you think there are any benefits to cleaning the inside of the dryer cabinet?*

- Yes
- No
- I don't know

Page 18

21. What do you think are the benefits of cleaning the inside of the dryer cabinet?

Page 19

22. Have you or anyone else ever cleaned the inside of your dryer duct along its full length?*

- Yes
- No
- I don't know

Page 20

23. About how long ago was the last time you had the dryer duct cleaned?

Page 21

24. Do you think there are any benefits to cleaning the dryer duct?*

- Yes
- No
- I don't know

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25. What do you think are the benefits of cleaning the dryer duct?

Page 23

26. Have you or anyone else ever checked your dryer exhaust exit, outside, for blockages?*

- Yes
- No
- I don't know

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27. About how long ago was the last time you checked the exhaust exit for blockages?

Page 25

28. Have you ever experienced a fire that was later determined to be related to a clothes dryer?*

- Yes
- No

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29. Was a specific part or location on the clothes dryer identified as the source of the fire?*

- Yes, a specific part or location on the dryer was identified.
- No. The dryer was involved, but no specific parts or locations were identified.
- I don't remember

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30. What was the specific part or location on the clothes dryer that was identified as the source of the fire?

- Rotating drum
- Control panel
- Electrical plug or cord
- Thermostat
- Lint trap

- ○ Motor
- ○ Heater coil
- ○ Dryer duct/vent
- ○ Timer
- ○ Electrical system
- ○ Other, please specify

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31. Was lint specifically identified as the first item that caught fire?

- ○ Yes
- ○ No
- ○ I don't remember

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Thank you for taking the time to complete this survey. The following are some recommendations to help dry your clothing efficiently and prevent dryer fires:

• Clean the lint screen/filter before or after drying each load of clothes. If clothing is still damp at the end of a typical drying cycle or drying requires longer times than normal, this may be a sign that the lint screen or the exhaust duct is blocked.

• Clean the dryer vent and exhaust duct periodically. Check the outside dryer vent while the dryer is operating to make sure exhaust air is escaping. If it is not, the vent or the exhaust duct may be blocked. To remove a blockage in the exhaust path, it may be necessary to disconnect the exhaust duct from the dryer. Remember to reconnect the ducting to the dryer and outside vent before using the dryer again.

• Clean behind the dryer, where lint can build up. Have a qualified service person periodically clean the interior of the dryer cabinet, between the rotating drum and the exterior surface of the dryer, to minimize the amount of lint accumulation. Keep the area around the dryer clean and free of clutter.

• Replace plastic or foil, accordion-type ducting material with rigid or corrugated semi-rigid metal duct. Most manufacturers specify the use of a rigid or corrugated semi-rigid metal duct, which provides maximum airflow. The flexible plastic or foil type duct can more easily trap lint and is more susceptible to kinks or crushing,

which can greatly reduce the airflow.

To end this survey, please click on NEXT.

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Thank you for taking the time to complete this survey. To end the survey, please click on DONE.