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THE EFFECT OF FONT TYPE ON MEMORY FOR INSTRUCTION

By
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A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of the requirements of the Sally McDonnell Barksdale Honors College

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Abstract

COURTNEY UPCHURCH: The Effect of Font Type on Memory for Instruction

The purpose of the present study was to determine whether or not one font type promotes superior memory retention for order over another. Participants were presented with one of three sets of instructions each displayed using a different style of font. They were asked to read the instructions and, following this, were provided with the instructions presented in a different, random order. Their task was to place the instructions back in the order in which they were originally presented. Results indicated that one font style led to better memory for order than the others. In addition, based on participant self-reports, one set of instructions was not perceived as being easier to follow than another. Overall, these findings suggest that the font style used to present instructions might contribute to the subsequent ability to remember the order of the instructions.

TABLE OF CONTENTS

ABSTRACT.....	iii
INTRODUCTION.....	1
METHODS.....	6
RESULTS.....	9
DISCUSSION.....	11
REFERENCES.....	15
FIGURES.....	16
APPENDICES.....	18

The Effect of Font Type on Memory For Instruction

Many studies have focused on factors that influence both readability and comprehension of text passages. For example, factors such as the length of a passage or the size and weight of a font have been found to influence how a passage is remembered. In some cases, experimenters have included distractions, which interrupt processing and draw attention away from the significance of the message. It has been concluded that lower quality text passages require more attention to comprehend, thereby reducing resources towards attention. The current study examines one specific characteristic of the font type itself and was designed to determine how that characteristic influences memory for the order of a set of instructions.

The relationship between memory for order and readability can be explored by manipulating the font type in which instructions are displayed. It is possible that the presence or absence of distinct markings could either interfere with processing by distracting the reader or further enhance processing by increasing readability. This effect on readability might influence the reader's perception of a passage. Therefore, perceived readability of instructions is also examined in this study. The perceived ease in which a passage is read often correlates with the ease in which an individual believes they could carry out a task. In other words, if a participant believes that a set of instructions is difficult to read or understand, they are less likely to have confidence in their ability to successfully follow the instructions. By asking participants to rate the ease with which they could follow a set of instructions, we hoped to gauge participants' perceived readability of the passage.

Gasser, Boek, Haffernan, and Tan (2005) explored the possibility that certain aspects of a font style could promote deeper processing of a passage. More attention on processing relevant information rather than attention on reading itself could enhance the depth of processing and lead to greater retention. For this experiment letter spacing and markers were considered. The spacing could be proportional to the size of each individual letter, or all letters could have an equal amount of spacing. Fonts could contain letter markers indicated with a serif or sans serif font style. Serif fonts contain a small line at the end of the main stroke, on either the top or bottom of the letter, while sans serif fonts lack these lines. Gasser et al. found that it was easier to read a serif font with proportional spacing than other types of fonts. More specifically, they proposed that the spacing and markings on the font gave letters the appearance of sitting on a straight line, which led to increased readability. A passage that is easier to read allows for more attention devoted to understanding the message of the passage and less attention on distracting details of the font.

Gasser, Boek, Haffernan, and Tan's study (2005) utilized four conditions consisting of a serif font with proportional spacing, a sans serif font with mono spacing, a serif font with mono spacing, and a sans serif font with proportional spacing. Participants first received a one-page paper discussing tuberculosis followed by a five-question survey regarding their attitude. This questionnaire served as a distraction task and was not scored for the results of the study. Next, participants were given a test with six questions relevant to the information previously read about tuberculosis. The six questions were open-ended recall rather than a multiple-choice recall.

Gasser et al. (2005) reported statistically superior recall of serif marked fonts over the recall of sans serif fonts. It was believed that because serif fonts sit on a line, lines of text can

be perceptually separated more easily, which, in turn, led to increased readability and deeper processing. Gasser, Boek, Haffernan, and Tan (2005) determined the use of a serif font to be of practical value for improving retention of information, especially when the information displayed is of great importance and related to health.

Song and Schwarz (2008) specifically studied the perceived ease in which individuals read a passage. More specifically, they asked participants to estimate the amount of effort involved in a task based on the font in which it is displayed. They suggested that factors that affect the ease of processing would also affect an individual's perception of the ease of the task. In their experiment, instructions were displayed in fonts that were considered either easy-to-read or difficult-to-read. They discovered that participants wrongly correlate the ease of carrying out the instructions to the perceived ease in which they read the instructions. Overall, they ran three experiments to provide evidence in favor of this idea.

In the first study by Song and Schwarz (2008), participants read a set of instructions describing an exercise routine. They received instructions with either an easy-to-read Ariel font or a hard-to-read Brush font. Participants were asked an open-ended question to estimate how many minutes they believed the routine would take. They were also asked to rate how quick the routine would feel. The next question asked participants to rate how likely they would be to adopt the exercise routine as part of their daily schedule. Once the study was complete, participants were asked two questions regarding details of the routine, and they rated how easy it was to read the font.

Song and Schwarz (2008) found that participants believed the Ariel font was easier to read than the Brush font. However, details recalled from the instructions were equal for both fonts. For the easy-to-read Ariel font, participants estimated the exercise to take less time and

feel quicker than those who read the hard-to-read Brush font. They also indicated they would be more likely to add the exercise into their daily routine when it was displayed in a font that was considered easy to read. The second experiment attempted to replicate these results using recipe instructions.

For the second experiment, Song and Schwarz (2008) used the same method with recipe instructions in place of exercise routine instructions. A new group of participants was asked to estimate the time needed to complete the recipe as well as rate their likeliness to complete the recipe. To test their recall, they were asked to answer yes or no to two questions regarding whether an ingredient was used or not. Once again, participants were asked to rate the ease with which the presented instructions could be read. The final experiment from Song and Schwarz (2008) used these same recipe instructions. Another set of participants were asked to rate how much skill a professional cook would need to complete the dish. They also rated the ease with which the font could be read and answered questions to test their recall.

For both the second and the third studies, Song and Schwarz (2008) concluded that the Ariel font was rated as the easiest to read. There was no difference between the two fonts for recall of information. In the second study, participants who read the Ariel font believed the instructions would take less to complete, and they would be more likely to complete the recipe. Those who participated in the third study and received the difficult-to-read font believed the recipe required more skill.

The overall results from Song and Schwarz (2008) suggest that a relationship exists between the readability of a set of instructions and the perception of how difficult the instructions would be to complete. The font that was more difficult to read led to the perception that instructions would take a longer time to complete, would be more difficult to

complete, and would be less appealing to complete. From this study it could be determined that instructions should be constructed with the intent to appear more appealing to readers, which would increase the likelihood of their engaging in that behavior.

The two previously mentioned studies by Gasser, Boek, Haffernan, and Tan (2005) and Song and Schwarz (2008) provide evidence for a relationship between readability and recall. This study attempted to extend the findings from the studies mentioned above to include memory for order. Both studies tested free-recall on memory of information from passages. In the present experiment, a reconstruction test was used to measure retention of information for order rather than a recall test. Reconstruction tests are often cited as being more sensitive than recall tests, given that more retrieval cues are provided at the point of the test. Thus, although differences in recall were not observed in the aforementioned studies as a function of font type, it is possible that memory for order might be.

In the present study, a set of instructions involving a real-world situation was presented to participants. As in Song and Schwarz's study, we predicted that presenting information using a serif font with markings would lead to better reconstruction performance than other sets of instructions. The distinct markings on letters provide a clear separation between lines, which should enhance readability. We also predicted that the ease of reading instructions should influence the perceived ease of completing instructions, thus indicating perceived readability. Enhanced readability might allow participants to focus more attention to the content of the message and lead to deeper processing of the presented information.

Methods

Participants

Seventy-eight undergraduate students, enrolled in an introductory psychology course at the University of Mississippi, participated in this study. The students voluntarily enrolled through the *Sona System* website to receive either partial course credit or extra credit in their class.

Design

A between-subjects design was employed with each participant reading the set of instructions printed in one of three font types. The set of instructions presented to participants remained constant, while the font used for the instructions was manipulated. Thus, font type was the independent variable whereas the dependent variables were rating the perceived ease of completing the task and reconstruction performance.

Apparatus and Materials

A packet was distributed to each participant upon arrival to the study. The first page displayed a set of instructions describing various steps to take in the event of a nuclear accident (see Appendix A). The instructions were presented in a serif font (*Lucida Bright*), sans serif font (*Lucida Sans*), or script font (*Lucida Handwriting*). A script font was selected to further measure the effect of increasing the difficulty of reading the passage on subsequent rating and reconstruction performance. The font family Lucida was used to provide consistency between the three font type conditions. On the second page of the packet, participants were asked to rate from 1 (extremely difficult) to 5 (extremely easy) the ease in which they believed they could complete the instructions. The third page consisted of

math problems to serve as a distractor task. The final page was reserved for participants to place the instructions back in correct order.

The last three pages all used a familiar Times New Roman font as a control to avoid influencing the results. The nuclear disaster instructions were obtained from a disaster preparedness website called “Ready.” For the purpose of this study, the instructions were modified and written in sequential order from 1-11. This enabled the reconstruction task to be easily scored.

Procedure

When participants arrived, they picked up a packet from the top of a stack. In this stack the three font conditions were alternated to ensure random distribution. Participants first read the set of instructions displayed on the front page of the packet. On this page, the instructions could be presented in either a serif, sans serif, or script font. With each font condition, the instructions were written numerically in order of completion from 1-11. (See Appendix A)

The second page asked participants to “rate how easy you believe it would be to carry out the set of instructions you just read. Indicate how easy the instructions would be by circling a number 1-5. 1 would indicate extremely difficult while 5 would indicate extremely easy.” On the following page participants completed a page of ten simple math problems, which served as a distraction task. These problems were not scored, and they did not contribute to the results. The last page of the packet required participants to reconstruct the order of the instructions they had previously read. The eleven instructions were scrambled with a blank beside each. Participants were instructed to write a number (ranging from 1-11) in each blank beside the instructions to indicate the order in which they were presented.

After completing this task, participants returned their packets. Each packet was sorted into their respective conditions and scored. To score, one point was awarded for each instruction that was numbered in the correct order. It took approximately twenty minutes for participants to complete the study.

Results

In the present study, participants read a set of instructions printed in one of three different font types (Script, Sans Serif, and Serif). They then completed a reconstruction test in which they were provided with the previously viewed instructions and asked to put them back into their original order. Given the importance of following the instructions in order, the primary dependent variable was the number of instructions that participants positioned correctly as a function of font type. The overall values are displayed in Figure 1 and are displayed as a function of serial position in Figure 2. An analysis of variance (ANOVA) revealed statistically significant differences in reconstruction accuracy as a function of the type of font used to display the instructions, $F(2, 75) = 3.39$, $MSe = 0.07$, $p < .05$, $\eta_p^2 = .08$. Planned comparisons indicated that participants were better at reconstructing the order of the instructions in the Serif condition than in either the Sans Serif condition, $F(1, 50) = 4.81$, $MSe = 0.31$, $p < .05$, $\eta_p^2 = .09$, or the Script condition, $F(1, 50) = 5.75$, $MSe = 0.07$, $p < .05$, $\eta_p^2 = .10$. However, performance was statistically equivalent between the Sans Serif condition and the Script condition, $F(1, 50) = 0.12$, $MSe = 0.08$, $p > .05$, $\eta_p^2 = .002$. These results suggest that participants' ability to remember the order of a set of instructions is enhanced when those instructions are presented using a Serif style font type.

We also asked participants to rate the likelihood that they would be able to correctly follow the instructions using a Likert scale ranging from 1 (extremely difficult) to 5 (extremely easy). This rating might provide clues about whether participants perceived a given font type to be easier to read, and thus act on, than another. An ANOVA, conducted to determine whether differences existed in participants' ratings of the difficulty of following the instructions as a function of font type was not statistically significant, $F(2, 75) = 0.07$,

$MSe = 1.25, p > .05, \eta_p^2 = .002$. Thus, participants did not rate one set of instructions as more difficult than another to follow based on the font type that it was printed in.

Discussion

A number of previous studies have examined how promoting deeper processing can enhance retention of information. Factors such as font size and font weight have previously been considered. For this study, the effect of specific font types on memory for the order of a set of instructions was examined. A set of instructions was presented in three separate fonts to determine if one font led to better reconstruction performance than another. After reading the instructions, participants rated the perceived ease of completing the task. Then, they attempted to remember the order in which the instructions were presented.

It was initially hypothesized that reading a serif font would lead to increased readability, deeper processing, and greater retention of information. Results from the study indicate that a serif font is in fact superior to a sans serif or script font. Because there was no significant difference between the sans serif and script font, it appears that they both cause increased distractibility when reading instructions. While serif and sans serif fonts seem to have only a subtle difference, a simple line at the end of a stroke had a significant effect. Removing lines at the top and bottom of a letter downgraded readability as much as to match that of a clearly distracting cursive font.

Two past studies were reviewed and modified as an attempt to reproduce findings that one font can surpass another to improve memory. While the 2005 study by Gasser, Boek, Haffernan, and Tan utilized a recall memory task, we focused on remembering the order of instructions. Although font type did not appear to influence recall of previously studied information, it did appear to affect reconstruction performance. Recall tests are typically used to test memory for word lists or memory for specific details in passages. For this study, the reconstruction task evaluated memory of an entire set of instructions considering full

knowledge is required for survival. The results of the reconstruction task suggested a serif font significantly improved memory over a sans serif or script fonts. It is possible that the method used for testing reconstruction influenced the results. Putting the instructions in sequential order potentially allowed the use of common sense, rather than memory alone, to reproduce the correct order. In future testing, it would be beneficial to explore the idea of using an open-ended reconstruction task. Open-ended reconstruction would provide further information on how deeply instructions could be processed using different font types.

In the 2008 study conducted by Song and Schwarz, participants read a set of instructions. For this study instructions were also used to present a real-life applicable situation to participants. Specifically, instructions for survival following a nuclear explosion were chosen because the situation is unfamiliar. While survival processing maximizes retention of information, individuals typically have no prior knowledge of how to respond to a nuclear disaster. Lack of knowledge prevents any influence on the results of a reconstruction task. Although nuclear instructions are not familiar, they do represent a potential, real-life situation. In the event that a disaster of this proportion did occur, it would be critical to retain information regarding instructions on how to respond. Instructions of this type have an advantage of showing the effect that font type has on retention of survival-related information. The nuclear instructions for this study were presented to participants in a sequential order. When reading instructions, the format most often consists of a step-by-step procedure. While this may not always be the case, the sequential order is more common and familiar. Future studies might include a more complex set of instructions that are not as clearly numbered. Instructions could possibly be presented in a paragraph format where the steps are not separated visually. Separating each step of the instruction would require more

attention toward the overall message thus leading to deeper processing. This could allow further measures on the effect of font type for depth of processing.

Perceived readability was examined in this study to reproduce the finding that readability correlates to ease of completing a task. In the 2008 study by Song and Schwarz, a positive correlation was discovered. However, we obtained different results. There was no statistically significant effect on rating the ease of completing the instructions as a function of font type. While readability does have an influence on retention of information (i.e. font type), the readability seemed to have no effect on perceived ease of completing instructions. It is possible that the instruction format for this study was easy for participants to read regardless of condition. Studies in the future might consider varying instruction types to examine the relationship between passage format and perceived readability. A set of sequential instructions could be compared to paragraph-style instructions to determine if instruction type has an effect on the reader's perception. Another potential influence on the insignificant difference between conditions is the length of the instructions. Increased length of a passage could also correlate to perception of ease. Longer instructions may appear more complex, thus more difficult to complete. Comparing short instructions to longer instructions might lead to identification of a relationship between length of passage and perceived ease of completion. Instruction length could also influence depth of processing. Increasing length would require participants to process more information. More attention would be given to the message causing deeper processing and greater retention of information.

A future study might also explore the differences between processing in different age groups. In this study, participants consisted of only college-level students. However, individuals with other various education levels might differ in their level of processing.

Participants to be compared might include lower educated children, higher educated adults, college-level students, and even uneducated adults. If research is expanded to multiple age groups with varying education levels, the effect of fonts on different levels of processing can be evaluated.

A significant result from this study suggests that the choice of font type for instructions is of great importance. It was seen that a serif font improved memory for disaster-related instruction, which would ensure safety and survival. Additionally, the beneficial effects of utilizing a serif-type font can extend to many different areas. For educational purposes, a serif font could cause elevated retention of information from textbooks as well as lecture notes, therefore improving test grades. A serif font used for a resume or job application might allow an employer to remember more about the applicant who used that font. In the professional world, Serif fonts could potentially be utilized as a marketing strategy to create more memorable advertisements. Ultimately, fonts with serif markings provide advancements in more areas than one. With further research and testing, more evidence can be produced to support the beneficial uses of typing with a serif font.

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- Song, H., Schwarz, N., If it's hard to read, it's hard to do: Processing fluency affects effort prediction and motivation. *Psychological Science*, 19 (10), 986-988.

Figure 1. Proportion of instructions placed in the correct positions as a function of font type.

Error bars indicate 95% confidence intervals.

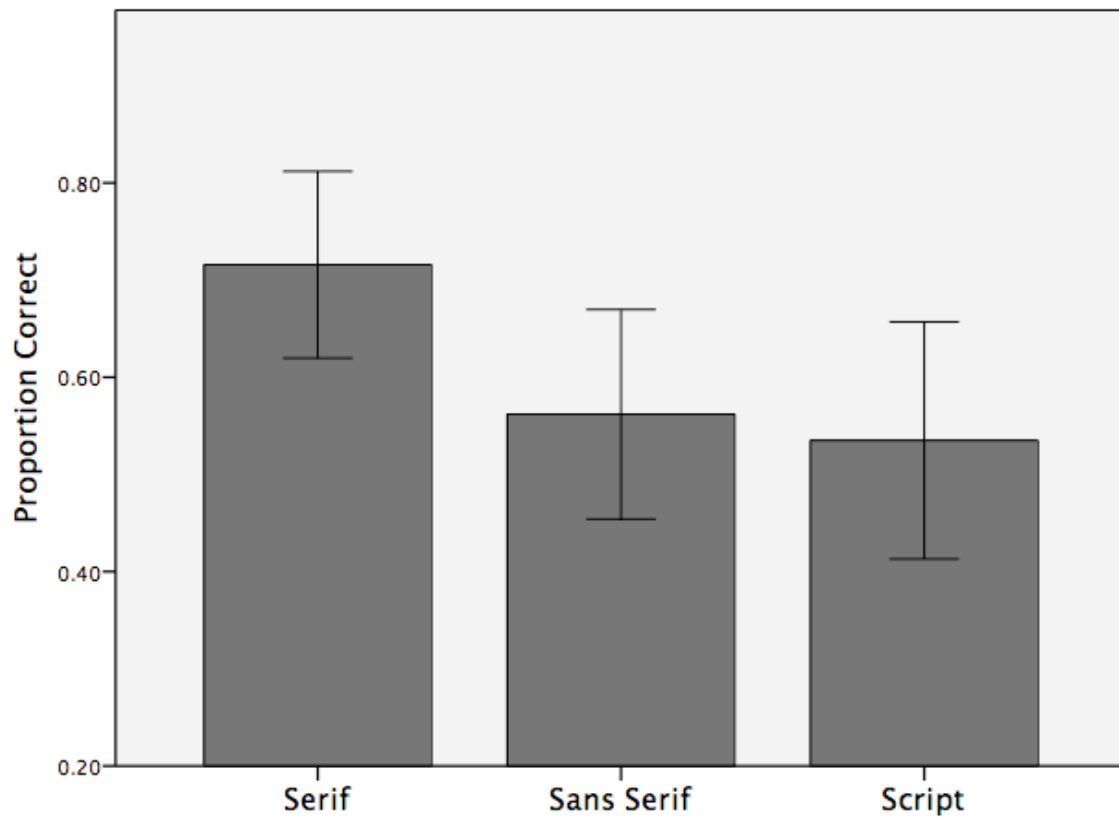
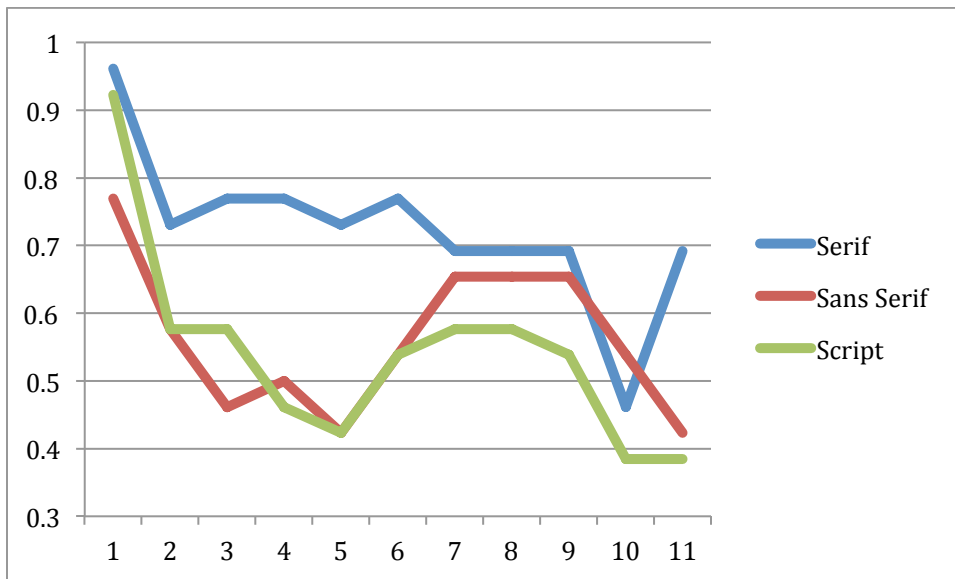


Figure 2. Proportion of instructions placed in the correct positions as a function of serial position (instruction 1 through 11) and font type (Serif, Sans Serif, and Script).



APPENDICES

Appendix A

Nuclear Disaster Response Instructions

1. Listen for official information and follow the instructions provided by emergency response personnel. Based on what is known about the threat, you may be asked to take shelter, go to a specific location or evacuate the area.
2. If you are caught outside and unable to get inside immediately Lie flat on the ground and cover your head. If the explosion is some distance away, it could take 30 seconds or more for the blast wave to hit.
3. Take shelter as soon as you can, Go as far below ground as possible or in the center of a tall building. The goal is to put as many walls and as much concrete, brick and soil between you and the radioactive material outside.
4. Once inside, stay where you are, even if you are separated from your family. Inside is the safest place for all people in the impacted area. It can save your life.
5. Expect to stay inside for at least 24 hours unless told otherwise by authorities.
6. If you were outside during or after the blast, remove your clothing to keep radioactive material from spreading. Removing the outer layer of clothing can remove up to 90% of radioactive material.
7. If practical, place your contaminated clothing in a plastic bag and seal or tie the bag. Place the bag as far away as possible from humans and animals so that the radiation it gives off does not affect others.
8. When possible, take a shower with lots of soap and water to help remove radioactive contamination. Do not scrub or scratch the skin.
9. Wash your hair with shampoo or soap and water. Do not use conditioner in your hair because it will bind radioactive material to your hair, keeping it from rinsing out easily.
10. Gently blow your nose and wipe your eyelids and eyelashes with a clean wet cloth. Gently wipe your ears.
11. If you cannot shower, use a wipe or clean wet cloth to wipe your skin that was not covered by clothing.

Appendix B

Reconstruction Task

Below, the instructions you previously read are now out of order. WITHOUT LOOKING BACK AT THE FIRST PAGE, please place the instructions in the order in which they were presented to you. Number 1 through 11 beside each instruction to place them back in order.

- _____ If you cannot shower, use a wipe or clean wet cloth to wipe your skin that was not covered by clothing.
- _____ If you are caught outside and unable to get inside immediately Lie flat on the ground and cover your head. If the explosion is some distance away, it could take 30 seconds or more for the blast wave to hit.
- _____ Take shelter as soon as you can, Go as far below ground as possible or in the center of a tall building. The goal is to put as many walls and as much concrete, brick and soil between you and the radioactive material outside.
- _____ Gently blow your nose and wipe your eyelids and eyelashes with a clean wet cloth. Gently wipe your ears.
- _____ If you were outside during or after the blast, Remove your clothing to keep radioactive material from spreading. Removing the outer layer of clothing can remove up to 90% of radioactive material.
- _____ Wash your hair with shampoo or soap and water. Do not use conditioner in your hair because it will bind radioactive material to your hair, keeping it from rinsing out easily.
- _____ When possible, take a shower with lots of soap and water to help remove radioactive contamination. Do not scrub or scratch the skin.
- _____ Expect to stay inside for at least 24 hours unless told otherwise by authorities.
- _____ Once inside, stay where you are, even if you are separated from your family. Inside is the safest place for all people in the impacted area. It can save your life.
- _____ If practical, place your contaminated clothing in a plastic bag and seal or tie the bag. Place the bag as far away as possible from humans and animals so that the radiation it gives off does not affect others.
- _____ Listen for official information and follow the instructions provided by emergency response personnel. Based on what is known about the threat, you may be asked to take shelter, go to a specific location or evacuate the area.