

Engineering Process Safety Research Instrument (EPSRI)

The following survey will provide you with prompts to read, after which you will be asked to state your preference for which action to take, then rate your importance of the questions provided in your decision making process on a rating scale of 1 to 5 (1=Great, 2 = Much, 3=Some, 4=Little, 5=No) and finally rank the questions in terms of importance from first to fourth most important (out of the list of questions provided). Note that some of the items may seem irrelevant or do not make sense. In that case, rate the item as "No" importance and do not rank the question. Make sure you consider all questions printed after each prompt in your ratings and rankings.

Prompt 1:

As a design engineer at a large plastics manufacturing facility, your responsibilities include identifying specifications for replacement parts and new equipment. One of the manufacturing processes in your facility requires transporting a dangerous chemical which is fatal to humans upon exposure through metal hoses lined with polymer. You must choose the hose used to carry this dangerous chemical, and you find there are two options for these hoses: Option A is a hose lined with a polymer that slowly breaks down upon exposure to the chemical - it is fairly inexpensive, but would need to be replaced on a monthly basis to avoid leaks and/or accidental sudden discharge of the chemical in the facility. Each monthly replacement of the Option A hose brings with it elevated risk of exposure to the fatal chemical, but maintenance procedures are in place to minimize the risk under normal conditions. Option B has a more expensive polymer liner which offers greater resistance to attack by the chemical, and so the hose would only need to be replaced each year. You determine that it would be more expensive to specify Option B on an annual basis, while Option A would offer savings with a similar level of safety under normal operation. You receive a \$5,000 bonus for each year that you keep equipment costs below a certain level, and you are currently projected to spend above this threshold level - specifying Option A would go a long way toward producing the savings needed to receive your bonus.

Which hose would you choose?

- ☐ Option A - Inexpensive hose replaced monthly
- ☐ Can't Decide
- ☐ Option B - Expensive hose replaced annually

Rate the following issues in terms of importance (1-5). Note that some of the items may seem irrelevant or do not make sense. In that case, rate the item as "No" importance and do not rank the question.

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. How important is it to you to maximize your salary with a bonus?					
2. Are you concerned that selecting Option A might require more of your employees' time?					
3. Would you gain personal satisfaction from “doing a good job” if you choose one option over the other?					
4. Do you think that management will cancel work due to the weather tomorrow?					
5. How much risk to the surrounding community is associated with replacement of hoses for each option?					
6. Would process reliability be affected by hose choice?					
7. Is it ever a good idea to rely on active measures (in this case, employee maintenance) rather than inherently safe design (in this case, material of construction)?					
8. Would your fellow employees have a more positive opinion of you if					

you chose one option or the other?					
9. Do the polymer linings for each option match the color of the pipe?					
10. Would choosing Option B benefit the company?					
11. Would you earn additional recognition and career opportunities by keeping costs low?					

Rank which issue is the most important (item number).

	1	2	3	4	5	6	7	8	9	10	11
Most important item (1)											
Second most important (2)											
Third most important (3)											
Fourth most important (4)											

Prompt 2:

You are an engineer at a chemical company that produces chemical additives for the gasoline industry located in the gulf coast region of the United States. The plant is located in the suburbs of a major city. Part of your responsibilities include oversight of safety systems on several large storage tanks of volatile organic precursors that are used in the manufacture of your company's main product. The temperature control on these tanks is important, since at elevated temperatures, the increased volatility may pose a risk of tank over pressurization or even explosion. Today, the National Weather Service announced that their models are predicting a severe hurricane that has a significant probability of impacting the region where your plant is situated. While you are confident that the plant has been designed to withstand the appropriate wind loads, this particular storm is predicted to bring about unprecedented flooding, which you are not certain the plant has been designed to tolerate. The temperature control loops and associated equipment are connected to backup generators in the event of a power failure, but the generators themselves will fail if exposed to floodwaters, leaving the tanks uncontrolled. The effects of a release of the volatile material are largely unknown, especially under storm conditions, and an explosion, depending on the magnitude, could cripple or destroy the plant. The storm is still several days away, giving you some time to reach a decision on a course of action.

What should you do?

- ☐ Option A - Take no action and hope potential flooding will not compromise the generators
- ☐ Can't decide on a course of action

- ☐ Option B - Solicit volunteers to stay through the storm and attempt to keep the generators functioning

Rate the following issues in terms of importance (1-5). Note that some of the items may seem irrelevant or do not make sense. In that case, rate the item as "No" importance and do not rank the question.

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. What is the potential for negative impact to the environment if the tanks release their contents?					
2. Is there the potential for the exploding tanks to damage the surrounding neighborhood and infrastructure adjacent to the plant?					
3. What is your level of comfort in soliciting volunteers to stay on-site during what may be a life-threatening situation?					
4. What is your level of concern regarding your own personal safety if you choose to stay on-site during the storm?					
5. How much faith do you have in your local meteorologist?					
6. What is your confidence that you and/or your team will be able to keep the					

generators functioning under the storm conditions?					
7. Would staying to prepare the tanks jeopardize you and your family's safety in the upcoming storm?					
8. How would your company be perceived if no employees were on site during the storm and an accident occurred?					
9. Are you concerned whether pizza will be able to be delivered to the plant during the storm?					
10. What is the potential for negative health effects on residents who live in the areas surrounding the plant if the tanks release their contents?					
11. Is the plant located in an area where dangerous impacts to the surrounding community are likely?					

Rank which issue is the most important (item number).

	1	2	3	4	5	6	7	8	9	10
Most important item (1)										
Second most important (2)										
Third most important (3)										
Fourth most important (4)										

Prompt 3:

You are an engineer who has just been hired by a start-up company that makes personal care products for your first job out of college. On your first day, one of your co-workers offers to take you for a tour around the plant. On the tour, you notice a valve that appears to be leaking steam. “Oh that? It leaks sometimes, but it hasn’t hurt anyone yet. It’s easy enough to work around,” your co-worker replies. As you begin to question them further, your co-worker tries to reassure you by saying, “Don’t worry about it! It’s your first day and you’re still learning the ropes here. Just make sure you have safety glasses and heat-resistant gloves and you’ll be fine.”

What should you do?

- ☐ Option A - Report the leak to a manager
- ☐ Can’t decide on a course of action
- ☐ Option B - Ignore the leak and work around it as your co-worker suggests

Rate the following issues in terms of importance (1-5). Note that some of the items may seem irrelevant or do not make sense. In that case, rate the item as "No" importance and do not rank the question.

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. How often is maintenance performed on the equipment in the plant?					
2. If you ignore the leaky valve, are you contributing to a negative engineering safety culture overall?					

3. How big of a bucket is available to collect the leaking material from the valve?					
4. Will the leaking valve be a common nuisance for you, or is it located in a part of the plant you will seldom visit?					
5. How often is the valve used?					
6. Is it ever acceptable to not report a potential safety hazard?					
7. Will you face negative repercussions from reporting the leak?					
8. What other people or equipment may be exposed to the steam leak?					
9. How much time or effort would it take you to have the valve inspected?					
10. Would you be looked at as a “worrier” if you report the leak?					
11. Can any safety hazard, regardless of how minor, be dismissed as simply an “annoyance”?					

Rank which issue is the most important (item number).

	1	2	3	4	5	6	7	8	9	10	11
Most important item (1)											

Second most important (2)											
Third most important (3)											
Fourth most important (4)											

Prompt 4:

You are working as an operator at an oil company refinery over the summer months. You are told by your engineering supervisor to open a pump's inlet plug valve in order to place the spare hazardous chemical pump in service. When you get to the valve with your coworker, you manually turn the wheel to open the valve as you have been instructed but the valve doesn't open. Your co-worker suggests unbolting the top portion of the valve to allow you to use a wrench to manually open the valve as this has been done multiple times before when this issue has occurred. You are concerned that if you dismantle the top portion of the valve, you might unwittingly impact safety measures that are in place to control the hazardous chemical flow.

What should you do?

- ☐ Option A - Tell your co-worker that you want to speak with the engineering supervisor prior to doing anything
- ☐ Can't decide on a course of action
- ☐ Option B - Listen to your co-worker and dismantle the top portion of the valve to allow you to manually open it

Rate the following issues in terms of importance (1-5). Note that some of the items may seem irrelevant or do not make sense. In that case, rate the item as "No" importance and do not rank the question.

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. Are there any health risks associated with a hazardous chemical leak that could					

impact the local community?					
2. Would your co-worker lose confidence in your abilities if you asked for assistance?					
3. Would the engineering supervisor be irritated with you if you asked for help?					
4. How many bolts will need to be undone?					
5. Would leaving the valve as-is cause a loss of production?					
6. What is the possibility of a larger issue, such as an explosion or fire, if a hazardous chemical were to leak from the valve?					
7. What impact would a hazardous chemical leak have on the environment?					
8. What tools do I need to unbolt the valve?					
9. Would a hazardous chemical leak impact the company's image?					

Rank which issue is the most important (item number).

	1	2	3	4	5	6	7	8	9
Most important item (1)									
Second most important (2)									

Third most important (3)									
Fourth most important (4)									

Prompt 5:

You are working in the R&D department of a small chemical company that produces specialty coatings for the biomedical industry. Through the product's development, the process has become reliant on a chemical additive that significantly improves the reaction rate of your primary reaction. The additive has catalytic properties which shortens overall reaction time and thus increases production. Over the years, there have been a number of studies and reports that implicate this additive in a variety of potentially harmful outcomes, both environmental and personal health related. Though you and your coworkers observe all appropriate chemical hygiene protocols regarding the additive, you are all regularly exposed to it in the course of your work. Because of the chemical nature of the additive, it does not readily break down in nature or in biological systems, and as such, it has been found in the environment in places not normally expected, including in water sources and wildlife, where negative consequences are predicted but still unconfirmed. As such, the Environmental Protection Agency has not taken any action or issued any concrete guidelines on the continued use of this additive. Your company is small, and so the total volume of this additive you use on a yearly basis is also small - significantly smaller than in other processes where it might be used. Additionally, without an obvious replacement, internal data shows that your product throughput would decline substantially were you to phase out your usage of the additive. Your supervisor has asked you to look at the latest data and make some recommendations for the future of this process while production continues, and would like that recommendation within the month.

What should you do?

- ☐ Option A - Spend the month looking for alternative chemistries that may work in your existing process to replace the current additive
- ☐ Can't decide on a course of action
- ☐ Option B - Decide that your usage volume and the ambiguity of the data on the consequences of exposure do not warrant any changes to your process at this time

Rate the following issues in terms of importance (1-5). Note that some of the items may seem irrelevant or do not make sense. In that case, rate the item as "No" importance and do not rank the question.

	Great (1)	Much (2)	Some (3)	Little (4)	No (5)
1. What is the potential for lost production if you discontinue the additive without finding a suitable replacement?					
2. Are you concerned that your yearly bonus will be impacted if your company discontinues the use of this chemical?					
3. What is the potential impact on your coworkers' jobs if the additive is banned and you didn't look for an alternative?					
4. Are you concerned that discharging the chemical could impact the local community?					
5. What is the difficulty and personal time investment it					

will take for you to find a replacement additive?					
6. How important to the company is it that the government agency in charge of environmental regulations has not issued any ruling on the continued use of this additive?					
7. What is the potential for negative environmental and human consequences if the additive is eventually proven to be dangerous?					
8. Are you concerned about your health since you are constantly exposed to the additive?					
9. Is there any additional time or money it would cost your company to replace the additive?					
10. Are you concerned about your job security if you should fail to find an appropriate alternative?					
11. Are you concerned that the replacement might have a name that is difficult to pronounce?					

Rank which issue is the most important (item number).

	1	2	3	4	5	6	7	8	9	10	11
Most important item (1)											
Second most important (2)											

Third most important (3)											
Fourth most important (4)											