Crisis Decision Making for Nuclear Leaders

Handbook

Version 1.1

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Table of Contents

About This Course

In response to the Fukushima Daiichi accident, the US nuclear industry recognized the need to better support its leaders who must assume leadership and make timely decisions in case of a beyond-design-basis event. This course is designed to help meet that need.

Exercises in the course are intended to challenge you and bring about the discomfort, or the memory, of stress. Our intent is to nudge you to the edge of your comfort zone so that you become more aware of your stress response.

The course has four parts:

- **Effects of Stress:** Definition of stress, and how it affects your performance and health; tools that you can use to treat your stress, and to help others experiencing extreme stress.
- **Stress Training:** Techniques to build up your body and brain to be able to handle the extreme stress of crisis conditions.
- **Decision Making Under Crisis:** Methods for applying your experience and expertise to decision making, and optimizing your judgments and decisions even under a crisis.
- **Crisis Leadership:** A case study exercise to familiarize you with tools for leading others when a crisis hits, taking into account the effects of stress and crisis conditions on the entire team.

How to Use This Handbook

Crisis Decision Making for Nuclear Leaders is a four-hour course designed to introduce you to a lifetime of professional improvement. The success of the course will depend on how well you apply this information in your life and career, starting today.

There are volumes of information on the topics of this course, and there are many sub-topics that you can research on your own. This guide is designed to help you review the four-hour session, and serve as your job aid for continued learning.

The main text parallels the material that was presented during the course. Keep in mind that your instructor might customize some of this material for your session.

Shaded boxes like this one contain articles on sub-topics for your further study after the session.

Learning Objectives

Given your role as an emergency responder, the terminal objective of this course is that you will understand and apply tools that support effective decision making under crisis conditions. Some of these tools are also described in the generic advanced FLEX course.

In support of this objective, this course contains the information you need to:

1. Define stress and describe its effects on the brain and body.
2. Describe how stress resilience and tolerance affect your ability to perform under stress.
3. Apply tools for recognizing, checking and controlling the effects of stress for yourself and others.
4. Contrast rational and intuitive decision-making methods and their applications.
5. Discuss methods that support effective decision making during crisis conditions.
6. Describe the influences of emotions on leaders during a crisis.
7. In a simulated nuclear plant crisis event, apply methods for decision making under stress using the concepts and methods presented in this course.

Will You Be Ready?

During a crisis, your operating procedures will not apply as usual.

A *crisis* is a beyond-design-basis event in which the environment is volatile, uncertain, complex and ambiguous. Your operating procedures will not apply as usual. As such, it is an event we can't fully foresee or prepare for.

It is human nature to believe that it won't happen to you. The people at Fukushima Daiichi, and others you will hear about in this course, are people just like you, who had no more reason to suspect a crisis than you do today.

The nuclear power industry has a unique responsibility to protect the health and safety of the public. None of us can afford to be unprepared for a crisis.

In this course, we will talk about what made some people more ready than others to cope and lead during extraordinary events.

Use this course to be as ready as you can be.

Threshold of Concern

"There is simple human nature – there is a 'threshold of concern,'" says Howard Kunreuther, Wharton professor of operations and information management and co-director of the Risk Management and Decision Processes Center. "You have a lot of things to worry about, and often when you talk about what the chances are of an accident like [Fukushima] occurring, the general feeling is that it's not going to happen to me."

One way to combat this natural tendency, suggests Kunreuther, is to "stretch time horizons, so you don't just think about the likelihood of this occurring next year but over a period of years."

The probability of an event, or series of events, increases considerably "when you look at the situation over the next 20 years instead of over the next year."

Source: Initiative for Global Environmental Leadership and Knowledge@Wharton 2013

Effects of Stress

This course begins with an exercise that puts you in the center of a crisis at a nuclear power plant. How did you and your team do? Was the experience tense, confusing, or even chaotic?

The *stress response* is the body's personal reaction to the demands placed on it.

Your reactions are clues to your *stress response*, which is your body's personal reaction to the physiological or mental demands placed on it.

You'll notice that every person's stress response is a little bit different. For example, one person might feel mentally scattered while another will experience greater focus, or even tunnel vision.

Your Stress Response

Periodically, take a look at the **Stress Response Checklist** (Handout 3). Check off the symptoms of stress that you experienced during the course activities, or at other stressful times. Add other items to the list as needed.

Please note that the information on the checklist is personal. It is for your use only.

Definition of Stress

When we say “stress” we are typically talking about negative stress. Any crisis event will cause severe negative stress. Stress changes everything about the way we respond to what happens around us, so we have to learn about stress if we expect to be able to lead under its influence.

Here is a scientific definition of negative stress[1] that will help us to discuss it in precise terms. It occurs in the presence of three conditions:

Condition	Scientific Definition	In Other Words
1	The perception that success in meeting the demand is important	Is it important?
2	The perception that I must be the person to fulfill the demand	Am I required to do it?
3	The perception that the demand might exceed my abilities	Can I handle it?

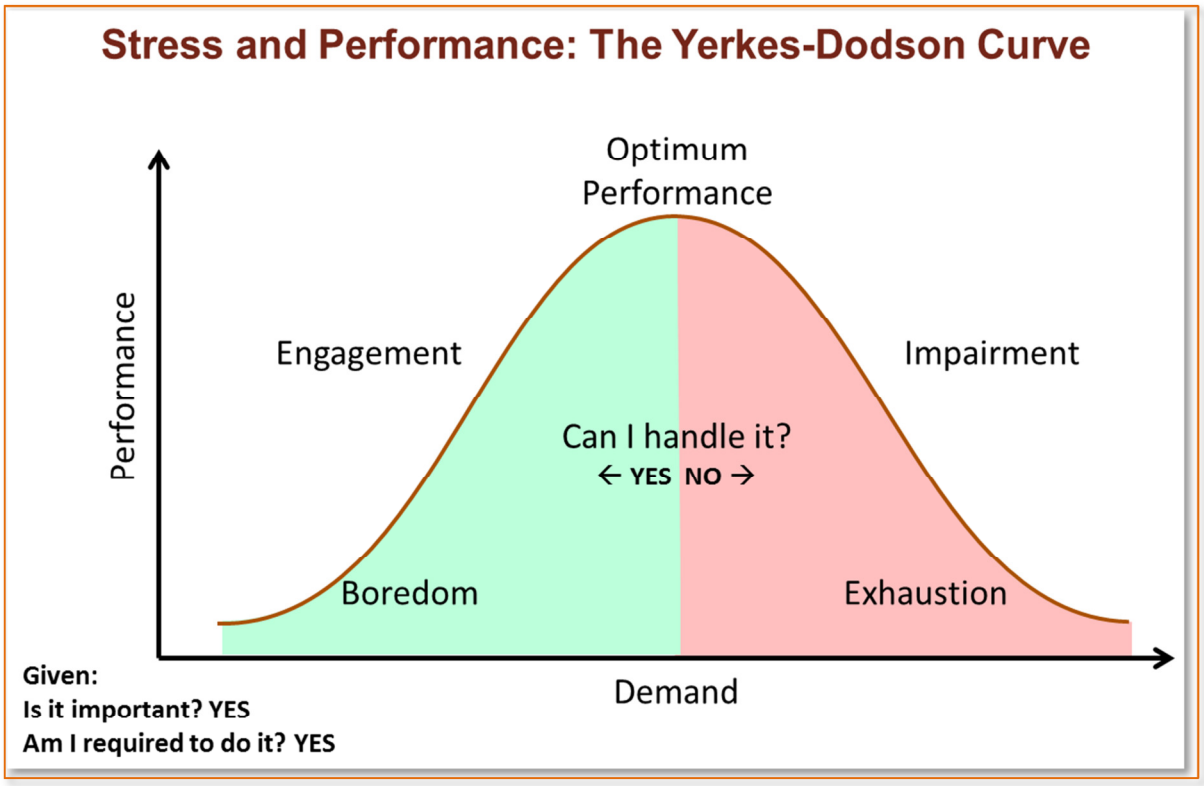
Note that if you are lacking any one of these three perceptions, you won’t feel the negative effects of stress.

[1] Source: Staal, 2004. Adapted from McGrath, J. E. 1976. "Stress and behavior in organizations." In *Handbook of Industrial and Organizational Psychology*. Dunnett, M. D. (ed) Chicago: Rand McNally College Publishing.

Stress and Performance

The stress response is both positive and negative. It kicks in when we get excited about a challenge, or when we need an extra boost of energy to cope with a threat. It is our "fight or flight" response. It can also lead to clouded judgment and unpleasant physical symptoms.

When does stress go from good to bad? This chart, known as the Yerkes-Dodson Curve, illustrates the general relationship between performance and the mental and physiological demands that cause stress.



On this curve, the first two criteria of stress are givens: the task is perceived to be (1) important and (2) required of the individual. The third criterion, "can I handle it?" is represented by the line at the peak of the curve. When the answer to that question changes from "Yes" to "No," performance starts to decrease and stress becomes harmful.

- **Boredom:** Not enough is happening to trigger a stress response.
- **Engagement:** Some demand is placed on us that is within our abilities. Stress hormones give us energy and focus.
- **Optimum Performance:** There is a high point where we reach the limit of our abilities for a particular task or situation.

- **Impairment:** We can no longer handle the demand. Performance decreases, and we feel the negative effects of the stress response.
- **Exhaustion:** The stress response overcomes our ability to function.

Stress: The Long and the Short of It

Stress is blamed for many health problems, but our bodies respond to stress in order to help us cope, not to wear us out. When we perceive a stressful situation, the brain's sympathetic nervous system triggers a chemical bath of stress hormones that affect many organs throughout the body. Here are just a few stress hormones and their effects:

- Adrenaline (also known as epinephrine) increases the heart rate and narrows the blood vessels so that more oxygen gets to our cells at a faster rate.
- Cortisol increases our glucose and decreases our insulin, to give us a boost of sugar energy, while also suppressing any inflammation so we feel less pain as we exert our muscles.
- Dopamine can produce an exhilarated or excited feeling, and increase our short-term memory while decreasing long-term recall. In extreme cases, we can experience a "flash bulb" memory of the moment the stressful event occurs.

In the short term, while we are coping, these effects are beneficial. However, if stress is sustained over a long period, these effects can devastate the body:

- Chronic levels of adrenaline lead to high blood pressure and heart disease.
- Over time, cortisol causes weight gain and diabetes.
- Dopamine in large amounts can lead to memory problems and possibly brain diseases such as Alzheimer's and Parkinson's.

Recognize your stress responses in both the short-term and the long-term, so that you can take advantage of the benefits and avoid the harm of exposure to stress hormones.

More: *The Stress Effect* by Henry L. Thompson

Empatica Wrist Monitor Data

Here are descriptions of the types of data recorded by the Empatica E4 biofeedback monitor that is provided with this course.

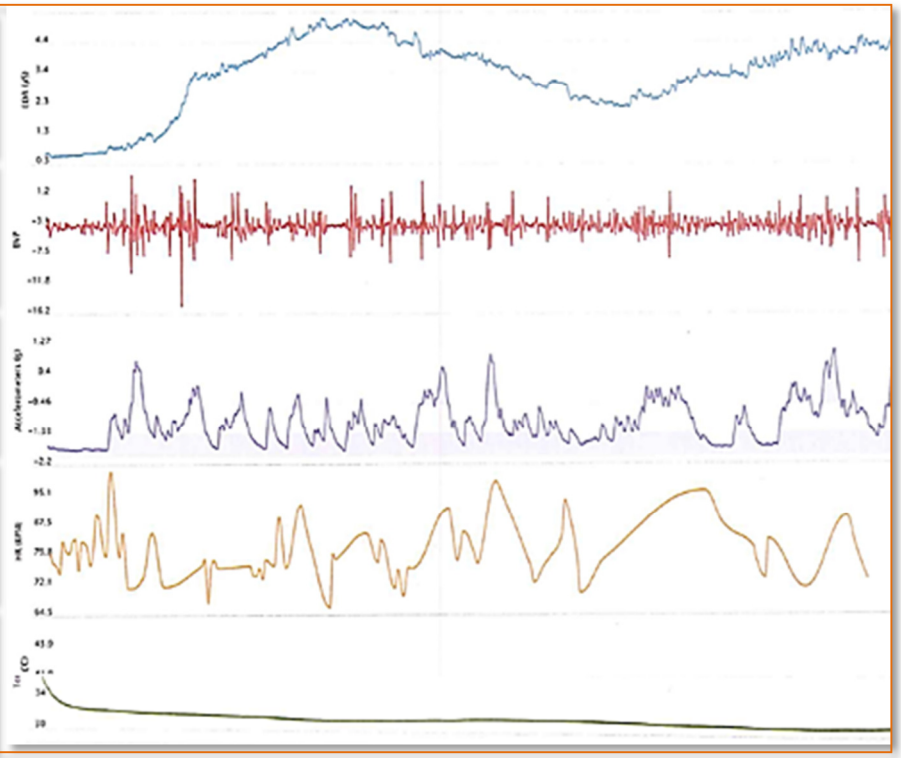
EDA=Electrodermal Activity
Indicates stimulation of the sympathetic nervous system.

BVP=Blood Volume Pulse
Indicates changes in heart rate

Accelerometer: *Captures motion-based activity*

HR (BPM)=Heart Rate (beats per minute) Calculated from BVP.

Temp (°C)



How the Empatica Wrist Monitor Works

Our autonomic (involuntary) nervous system has two distinct subsystems that operate independently:

- The sympathetic system controls the stress response.
- The parasympathetic system controls the relaxation response.

Interestingly, these systems are not necessarily in synch. That is why you might feel like there is a battle going on inside you when you try to oppose stress: there is. Using stress management techniques to trigger the relaxation response will help you to feel better, but the stress response is still at work.

The skin receives stress signals, but not relaxation signals. The biofeedback monitor detects subtle electrical changes on the skin that are caused by stress.

More: Empatica develops the wearable device provided with this course. Learn more at https://www.empatica.com/science.

Stress Treatment

Stress treatment tools are techniques you can use for yourself, or recommend to others, to mitigate the effects of the stress response. The effectiveness of any of these tools will vary, depending on the individual and the stress response they are experiencing.

Control Your Breathing

Controlling the breathing is the most powerful stress reduction tool. Not only does it regulate oxygen intake, but it is also the best way to send signals to the brain that regulate the stress response.

Breathing is the only function that is tied to both the voluntary (somatic) and involuntary (autonomic) nervous systems. On the autonomic side, it also gives and receives messages from both the sympathetic system, which controls the stress response, and the parasympathetic system, which controls the relaxation response. Therefore, when we control breathing voluntarily during a stressful situation, we send signals back to *both the stress and relaxation centers* of the brain to regulate stress symptoms.

Breathing Exercises

Try the breathing exercises below. You will see that they all involve slowing the breath while still getting plenty of oxygen. It is also important to exhale fully to expel carbon dioxide.

Equal breathing: In through the nose for four counts. Out through the nose for four counts. For more relaxation, increase to six or eight counts.

Nostril breathing: Inhale deeply through the left nostril for four counts. Exhale through the right nostril for four counts. Repeat for 1-3 minutes. Reverse the flow.

Abdominal breathing: Place hand on abdomen. Extend the diaphragm, not the chest, to fill the lungs completely. Inhale through the nose for four counts. Exhale through the nose four counts, pushing to expel air from the diaphragm. Repeat 10 times.

Intense abdominal breathing: Begin the same as regular abdominal breathing. Suddenly expel air through the nose in one count, pushing with diaphragm. Repeat 10 times. (Avoid if pregnant or with heart condition.)

More breathing exercises: Shakeshaft, 2012

Act Calm, Feel Calm

Your brain is constantly monitoring what's happening in your body. It analyzes muscle tension, posture, heart rate, breathing, and even facial expressions to judge how you are feeling. You can apply the practice of "fake it 'til you make it" to stimulate your body's relaxation response while also positively influencing others:

- **Smile and laugh:** Smiling and laughing relaxes muscles and slows the heart rate. In addition, studies link smiling facial expressions, even without happy emotions, to reduced cortical and increased endorphins.
- **Take a power stance:** Studies show that standing in a confident "superhero" position, or sitting in a relaxed posture with feet up on a desk or table, reduces cortisol and stimulates other hormones that boost feelings of power and control.
- **Slow down:** Consciously slowing down speech, gestures, and body movements reduces the heart rate.

How to Treat a Panic Attack

If someone on your team has a panic attack, they might not be able to think clearly enough to help themselves. You can help them by doing the following:

- Move the person to a quiet place.
- Stay with the person and keep calm.
- Speak to the person in short, simple sentences.
- If the person has medication for a panic attack, help them to take it.
- Don't make assumptions about what the person needs. Ask.
- Be predictable. Avoid surprises.
- Help the person focus by asking him or her to repeat a simple, physically tiring task such as raising his or her arms over the head.
- Help slow the person's breathing by breathing with him or her or by counting slowly to 10.

Source: WebMD, http://www.webmd.com/a-to-z-guides/helping-someone-during-a-panic-attack-topic-overview

Interrupt Stress

These tools interrupt the stress response and divert attention away from stressors:

- **Snap a rubber band:** With a rubber band around your wrist, snap it onto the skin for a sudden sensation that can help you focus.
- **Count:** Any simple logical activity, such as counting from one to 10, or to 100 by threes, stimulates the logic centers of the brain and diverts energy from emotional responses.
- **Exercise:** Stretching relieves muscle tension that can be caused by stress. Cardio changes and resets the pace of breathing while burning off nervous energy.
- **Take breaks:** Even if you can only stand and stretch in place, take a few moments to focus your mind or regulate your breathing.
- **Change the environment:** Different temperature, air quality, sound or lighting provide new sensations that can calm the body. After intense work at a computer screen focus your eyes on an object in the distance.
- **Relax:** Repeat a focus word or sound while progressively relaxing all muscles from head to toes.

Stress Treatment Tools

Stress Treatment Tools (Handout 5) lists well-known techniques to counteract the effects of stress. Familiarize yourself with all of them, so that you can help others as well as yourself during a crisis. Remember that it is difficult to predict the stress responses that could emerge in an actual crisis.

Stress Training

Now that you know what to do about stress during a crisis, let's look at ways you can train in advance to better cope with stress.

Stress training will improve your capacity for coping with stress in two ways:

Stress training will improve how much you can handle, and how well you handle it.

- **Build Stress Tolerance:** By improving your stress tolerance, you'll make your personal stress response curve wider (handle more demands).
- **Build Stress Resilience:** By improving your stress resilience, you'll make your personal stress response curve taller (perform better).

Stress in the Brain

The effects of stress hormones on most organs is somewhat predictable, but not so for the brain. Different stressors affect different areas of the brain, and the effects on behavior vary from person to person.

For example, the same hormones that cause one person to experience laser focus on an important task can cause another person to experience tunnel senses, in which they tune out all sights and sounds in the periphery and lose situational awareness. While one person gains the vigilance to stand up to a threat, another might experience hypervigilance, clinging to a course of action even when it is not working.

Use the **Stress Response Checklist** to observe both the positive and negative cognitive stress responses that you observe in yourself and others. Keep in mind that the ways that people think and behave in response to stress can vary widely.

Use stress training techniques to enhance your positive stress responses.

More: *The Stress Effect* by Henry L. Thompson

Build Stress Tolerance

Stress tolerance describes how much demand you can handle before you feel the negative effects of the stress response.

Stress tolerance is the level of demand you can handle before you feel the negative effects of stress. Consider a balloon; the amount of air it can contain depends on its size, and the pressure that the material it is made of can withstand. If it is already full near to its limit, one more breath of air will burst it. Your ability to stretch to meet the demands of a challenging experience is your stress tolerance.

Why Stress Tolerance Matters

Consider this situation: Your life has become stressful lately. Whether it is from family pressures, financial pressures, or the demands of your job, chronic stress has started to wear you down. You are out of your exercise routine. Your temper is shorter than usual. People close to you are starting to ask about your health. Then one day while you are on shift, you hear an explosion. People are counting on you to make sense of what has happened and lead them through the event.

If your stress response is already triggered, the additional demands of a crisis might have unexpected negative effects on your body and your brain. By building your stress tolerance and being aware of it, you can have the capacity to handle whatever else might happen.

On the job, what are the top three methods for handling greater demand?

Nudge Your Comfort Zone

You can increase your stress tolerance by nudging your comfort zone—experimenting with handling more demand—and increasing your perception of what you are capable of doing.

What are some ways you can nudge your comfort zone, both on and off the job?

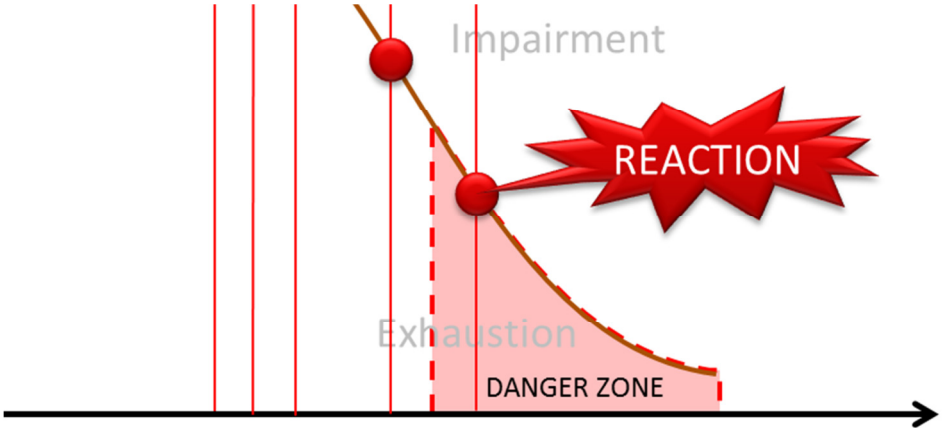
- Training, training, training
- Achieving "stretch goals"
- Taking on a special role in the plant, such as temporary supervisor during an outage or lead for a challenging project
- In sports, competing against better opponents
- Initiating an uncomfortable conversation
- Speaking or performing in front of an audience

As you nudge your comfort zone in any aspect your job or life, you are increasing your stress tolerance for all situations, because you are learning to cope with more pressure. Nudging your comfort zone anywhere will help you tolerate stress in a crisis at the station.

Conserve your Stress Response

Another approach to increasing stress tolerance is to save your capacity to tolerate stress for what matters. In other words, "don't sweat the small stuff."

Stress accumulates. Even small stressors, which you might consider to be part of everyday life, build upon each other to create a larger stress response. The more you can avoid other stressors, the more tolerance for stress you will conserve for truly important situations.



Reduce Everyday Stress

Stay ahead of the regular everyday things that will add stress to your life, such as, finances, maintenance, and family events.

Ask for help. If you have a chore that adds stress to your life, get someone to help you or do it for you.

Also, a healthy lifestyle helps keep you active and boosts your energy.

Adjust Your Perceptions

> Seek the serenity to accept what you cannot change, the courage to change what you can, and the wisdom to know the difference.

Seek a balanced perspective on the challenges you face. Consider the three criteria for negative stress:

- **Is it important?** Consider this question carefully. In reality, many daily stressors are not important in proportion to the stress we experience because of them.
- **Am I required to do it?** If you can get other people to do the tasks that add stress to your life, get them.
- **Can I handle it?** If your first response is "No," consider improving your skills or knowledge, managing expectations, getting help, or simply giving yourself the credit you deserve.

Ultimately, what is the worst that can happen? While possible consequences at a nuclear power plant can be very serious, possible consequences in other aspects of daily life are not always as serious as they first appear. To increase your stress tolerance, get into the habit of putting issues in their proper perspective.

Stress Training Checklist

Use the **Stress Training Checklist** (Handout 6) to keep a list of your personal stress training methods, whether you practice them already, or plan to practice them in the future. These are things you can do in your everyday routine to mitigate your negative stress responses. Refer to this checklist as you complete your **Crisis Decision Making for Nuclear Leaders Action Plan** (Handout 2).

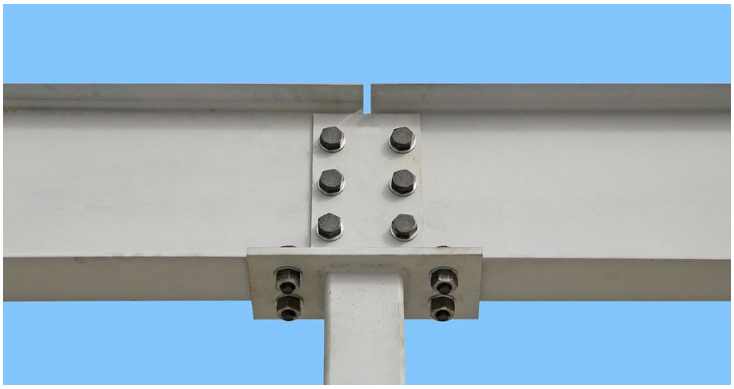
Build Stress Resilience

Resilience is the result of a strong but flexible mind.

Resilience is your ability to perform under the effects of stress, and bounce back. Consider a bar of steel. Resilience is the steel's ability to absorb energy without deforming. As you put load on it, it will deflect under the load. If the load is not too heavy, it has resilience: it will return to its original shape. However, if the load is too heavy, it will bend permanently or even break. Your ability to function normally during and after stress is your resilience.

Resilience is the result of a strong but flexible mind. Just as you exercise your body to gain physical resilience, you can exercise your mind to gain mental and emotional resilience.

Why Resilience Matters



Consider this situation: While you are on shift, a severe storm has devastated your community and knocked out AC power to the plant. Cell towers are down, and you can't get through to your family. It is likely that they are in danger. At the same time, you are leading your team to implement FLEX coping strategies under time pressure.

To cope under these circumstances, you need resilience to stay focused on the work you must do, and keep your emotions in check. These are abilities you can develop through daily practice, not only to prepare for a crisis, but also to become a better leader.

Focus the Mind

We all make mistakes occasionally due to lack of focus. It requires mental self-discipline to prevent the mind from wandering or being distracted. We can build that mental self-discipline by deliberately practicing mental focus. In other words, our minds (and even our brains) become stronger when we pay attention to our ability to pay attention, which is also known as *mindfulness*.

Developing this skill builds habits of mental self-discipline that can prevent lapses in focus and judgment during a crisis. What's more, it strengthens the parts of the brain that can be weakened by stress hormones.

To practice focusing the mind, whenever you notice that your mind has wandered from your current task or conversation, bring it back to what you are doing here and now. It is easier said than done, and it requires practice before it yields benefits.

Here are some ways you can focus the mind in your daily routine:

- **Singletask, don't multitask.** Texting while driving is an example of multitasking; it doesn't work, aside from being dangerous. Focus on one thing at a time, in spite of pressures to do otherwise.
- **Write lists.** Our minds fill with clutter when we try to memorize our to-do lists or shopping lists. Write it down, and then focus.
- **Reduce distractions.** If you find yourself constantly interrupted by emergent issues and questions during the day, devise ways to give yourself uninterrupted time. Close your door, or educate others on how to solve simple problems independently.
- **Minimize clutter.** If stacks of papers remind you of other things you need to do, put them away. Set aside time to tackle the stacks later, so you can focus on what you are doing now.
- **Use technology to your advantage.** Voice mail, email inboxes, and text messages are designed to store information until you are ready to process it. There is rarely a good reason to respond to every incoming message in real time. Turn off the notifications if necessary. Set aside time to respond to incoming messages later, so that you can stay focused throughout the day.

- **Listen—really listen—to others.** It's a common habit to think about what to say next, instead of truly hearing what is being said in the moment. Other times, our minds can wander during a conversation to another topic entirely. When you find your mind wandering, bring your focus back to the person who is speaking, and what they are communicating to you.

Keep in mind that it is natural for the mind to wander; when it happens, don't stress. Just notice it, and bring your mind back to focus.

Practice Self-Regulation

Self-regulation is the ability to think before acting, and keep disruptive emotions and impulses in check. This skill is valuable in a crisis, when the stress response can bring emotions closer to the surface.

Like practicing mental focus, self-regulation is easier said than done, and it requires daily practice. Here are some ways you can strengthen your ability to self-regulate:

- **Lead with integrity.** When you practice doing the right thing every day, you will be ready to do the right thing when stress weakens your defenses. Leading with integrity means consciously practicing what you preach, doing what is right even when it isn't easy, taking responsibility for your actions, and staying true to your values. Although it isn't always easy, practicing integrity is a major stress-reliever.

The Mindful Brain

Harvard neuroscientists have studied the effects of meditation and mindfulness on the brain. In people who took an eight-week mindfulness-based stress reduction program or a meditation course, there were changes in several different regions of the brain:

- The posterior cingulate, which is involved in mind wandering and self-relevance, decreased.
- The left hippocampus, which assists in learning, cognition, memory and emotional regulation, increased.
- The temporo parietal junction, or TPJ, which is associated with perspective taking, empathy, and compassion, increased.
- The pons, where regulatory neurotransmitters are produced, increased.
- In the group that meditated, the amygdala, the fight-or-flight part of the brain that produces anxiety, fear and stress, decreased.

Consider how these benefits could help you to manage stress and lead effectively during a crisis, and every day.

Source: Schulte, 2015

- **Do the hardest thing first.** When contemplating your to-do list, practice starting with the most difficult or onerous chore, and get it out of the way. This habit will discipline your mind to conquer difficult tasks and decisions. It will also reduce procrastination and boost productivity.

- **Reframe negative thoughts and emotions.** This practice is similar to "Controlling your Perceptions," as described previously. With this habit in place, you will be prepared to devise and discover more positive courses of action during challenging circumstances. This practice also increases your openness to change, which is important in a volatile crisis environment.

Boost Your Attitude

Pessimism is one of the brain's most reliable survival tools. However, a pessimistic outlook might not serve you when it comes to weathering a crisis. To build your stress resilience, try these techniques for increasing your optimistic perspective.

- Always act with a purpose. Make sure your efforts are always serving your greater goals.
- Stretch your limits every day. Try something new and challenge yourself.
- Take action without expecting results. Focus on what you can control, so that you won't be disappointed by unexpected outcomes.
- Use setbacks to improve your skills. Apply operating experience and lessons learned as opportunities to learn and grow.
- Seek out people with a positive attitude. It's a scientific fact your brain automatically imitates the behaviors of the people around you.
- Don't take yourself so seriously. Laugh about the small stuff and enjoy the mental and physical benefits of humor.
- Forgive the limitations of others. Holding people rigidly to an unnecessarily high standard is a recipe for disappointment.
- Say "thank you" more frequently. Gratitude helps you to see the good in life—an important factor in stress resilience.

Source: "8 Ways to Improve Your Attitude," by Geoffrey James, Inc.com. August 26, 2013. http://www.inc.com/geoffrey-james/8-ways-to-improve-your-attitude.html

Stress Resilience Support

Why do some people function more effectively than others do during a crisis? Scientists[2] have found that people with high stress resilience tend to believe:

- Their life has a meaningful purpose
- They can influence their surroundings and the outcome of events
- They can grow from both positive and negative life experiences

If any of these characteristics touches a nerve for you, keep in mind that working on these items will support your leadership skills and enhance your quality of life.

Here are some additional tools to help build resilience.

Build Your Support Network

People with a strong social support network live longer, because socializing builds resilience. If this is a challenge for you, consider spending more time with family and friends, and getting involved in groups or a church.

Meaning Saves Lives

Viktor Frankl (1905-1997) was a physician and psychiatrist before being sent to Nazi concentration camps during World War II. In the camps, he noticed that some of his fellow prisoners were determined to endure, while others reached a point of defeat, stopped working, and died for no apparent physical reason. In today's terms, he observed the limits of human resilience.

Frankl survived the camps and studied this phenomenon. He discovered that the most likely survivors of the camps were those who had strong family bonds, meaningful work, religious faith, or other strong connections. From this work, Frankl founded logotherapy, which helps people to turn the suffering or guilt of a traumatic event into meaning, learning, and positive action.

As you consider your own reaction to a highly stressful event, don't underestimate the value of meaningful work, beliefs, and connections with others to build your resilience.

More: *Man's Search for Meaning* by Viktor Frankl

[2] Garb, Howard N., and Cigrang, Jeff. "Psychological Screening: Predicting Resilience to Stress," in Lukey 2008.

Cultivate a Positive Attitude

Signs of a strong positive attitude are optimism based on reality, a drive to action, and taking responsibility for your own results. If this is a challenge for you, mindfulness can help. It also helps to spend more time with positive people, and doing activities that you enjoy.

Be a Life-Long Learner

Constant learning and openness to new ideas is also a way to exercise your brain. Activities include learning a new hobby, taking classes, or avid reading. It's important to stretch yourself out of your comfort zone. If this is a challenge for you, consider taking classes, traveling to broaden your horizons, or learning a language or other new skill.

Build Physical Resilience

Physically healthy people are stress resilient people. If you work to improve your exercise routine, nutrition, and quality of sleep, you will be building your stress resilience as well.

Leadership Requires Sleep

Decision making, problem solving, reasoning, planning, and executing are the work of the area of the brain called the prefrontal cortex. Neuroscientists have learned that while other parts of the brain cope relatively well with too little sleep, the prefrontal cortex cannot. When people are deprived of sleep, higher-order mental skills deteriorate the most.

In one study, after roughly 17 to 19 hours of wakefulness, individual performance on a range of tasks is equivalent to that of a person with a blood alcohol level of 0.05%, and after 20 hours, that number jumps to 0.1%, which meets the legal definition of drunk in the United States.

Source: Nick van Dam and Els van der Helm, "There's a Proven Link Between Effective Leadership and Getting Enough Sleep", *Harvard Business Review Online*, February 16, 2016 (Accessed May 9, 2016) https://hbr.org/2016/02/theres-a-proven-link-between-effective-leadership-and-getting-enough-sleep

More: *The Sleep Revolution* by Arianna Huffington

Decision Making Under Crisis

A decision is a commitment to one course of action where multiple alternatives exist. In a crisis, identifying the right course of action can be particularly challenging, because under stress we might tend to:

A decision is a commitment to one course of action where multiple alternatives exist.

- Experience emotions that lead to conflict.
- Perceive new information selectively, and perhaps miss something important.
- Feel rushed and take shortcuts.
- Have difficulty concentrating and focusing.
- Get tunnel vision.
- Succumb to "groupthink."

However, a crisis is just the time when good decision making is the most important. Fortunately, crisis decision makers do frequently make good decisions, even under the influence of stress. To understand how, we will look at two decision-making methods: one method that many organizations believe should be effective, and the other method that crisis decision makers actually use effectively, in the field.

Skills-Rules-Knowledge Model

As a basis for the decision-making methods, let's review skills-rules-knowledge model, which you might be familiar with as it is applied to error control (it is also known as the generic error modeling system, GEMS). We will use the same model to examine decision making in detail.

The skills-rules-knowledge model is based on these definitions:

- **Skills level:** Decisions resulting from preprogrammed instructions, habits, and reflexes that do not require much, if any, conscious thought before action.

  Reliability: Very high. Errors are rare and generally result from an aberrant slip.

  Example: Operators implement from memory their Immediate Operator Actions on indication that all ac power buses are de-energized.

- **Rules level:** Decisions resulting from if-this-then-that rules and procedures, whether in memory or on paper. Performance depends on the ability to recognize patterns or situations where the rule applies.

  Reliability: High. Occasional errors can result from misreading the pattern or situation, or from misapplying the rule.

  Example: Operators recognize the entry conditions and enter the abnormal operating procedure for responding to loss of spent fuel cooling.

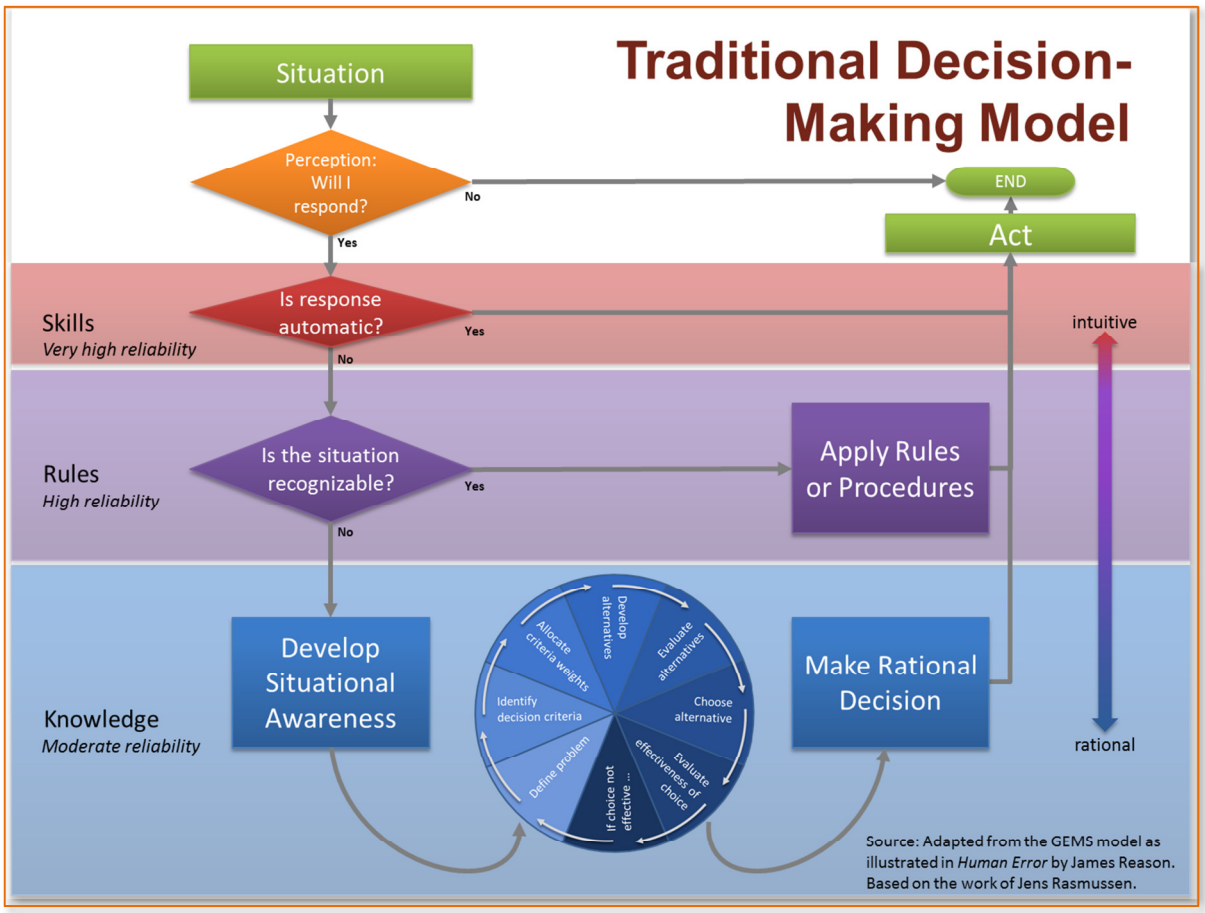
- **Knowledge level:** Decisions in novel situations that require conscious analysis of known information.

  Reliability: Moderate. There are many possible causes of error, including incomplete information, faulty logic, and biased thinking.

  Example: Unidentified reactor coolant system leakage is increasing, and at an escalating rate. If the current symptoms continue without change, the technical specification limit will be approached three weeks before the scheduled refueling outage. A decision is needed.

Decision Making: A Traditional View

Consider the decision-making processes represented in the diagram below. Many organizations prescribe these methods to their team members. We will see that this model, however, does not illustrate how decisions are actually made in a crisis.



The Decision-Making Challenge

The diagram above illustrates decision-making methods that range from intuitive at the top to rational at the bottom. Each type of decision has its benefits and drawbacks, and these are amplified in crisis decision making.

Which type of decision is better in a crisis, rational or intuitive?

Rational Decision Making

We assume that a rational decision-making process will help decision makers to overcome stress, avoid overlooking good options, arrive at the best possible decision, and be able to justify it later.

> Intuition is the way we translate our experiences into judgments and actions.
> —Gary Klein

However, we know that in practice, rational decision making doesn't fit the volatile, uncertain, complex, and ambiguous crisis environment:

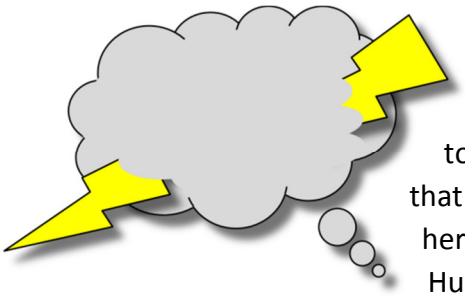
- The process takes too much time.
- In a crisis, you never have all the facts, so can't weigh every option correctly.
- Things keep changing in a crisis; you can't nail down the facts.
- The process enables "analysis paralysis," as indicated by the wheel in the diagram.

These are the reasons that the reliability in knowledge space is only moderate.

Intuitive Decision Making

Frequently, heroes of crises will say they simply knew what to do. They can't always say *how* they knew what they knew: they just knew.

The main disadvantage of acting on an intuitive decision is that without a logical process to follow, there is no way to challenge, support, or test the decision. Additionally, there is no teamwork, and no "Devil's Advocate"; you can't argue with "I just know." It's often difficult to trust one person's intuition.



However, it is during a crisis that we need the advantages of intuitive decision making: speed and a higher success rate. Intuitive decisions are more likely to be successful than rational decisions, as surprising as that may be. When they are correct, we think of them as heroic and even miraculous. (Example: see "Miracle on the Hudson," below.)

How can we use intuition in the skills and rules spaces when a crisis pulls us down into knowledge space?

How First Responders Decide

When a situation is recognizable, even in a novel way, a course of action becomes immediately apparent.

Researchers have studied how crisis responders actually make successful decisions.[3] Interestingly, they do not weigh and measure options in a rational way, not even very rapidly. Even when these decision makers are required to follow a rational decision-making process, they rarely use it; they take shortcuts, and go through the motions quickly to justify a decision they have already made by intuition.

The result of this research was the discovery of the decision-making process people actually use. It is called *recognition-primed decision making* (RPDM). This method was discovered, not invented. It is the natural way that experienced people quickly apply their knowledge. You don't have to learn how to do it; you only need to know how to be sure you're doing it well.

Miracle on the Hudson

In January 2009, US Airways Flight 1549 landed in the Hudson River in New York City just a few minutes after takeoff. Birds had flown into the engines, rendering them useless and turning the craft into a glider. Experience primed Captain Chelsey "Sully" Sullenberger to intuitively recognize his options within three minutes.

First, he and his co-captain performed sensemaking as they ruled out restarting the engines, returning to LaGuardia airport, or reaching Teterboro airport in New Jersey. Without any of the usual options remaining, Sully applied his pattern-recognition ability:

"The only level, smooth place sufficiently large to land an airliner was the river."

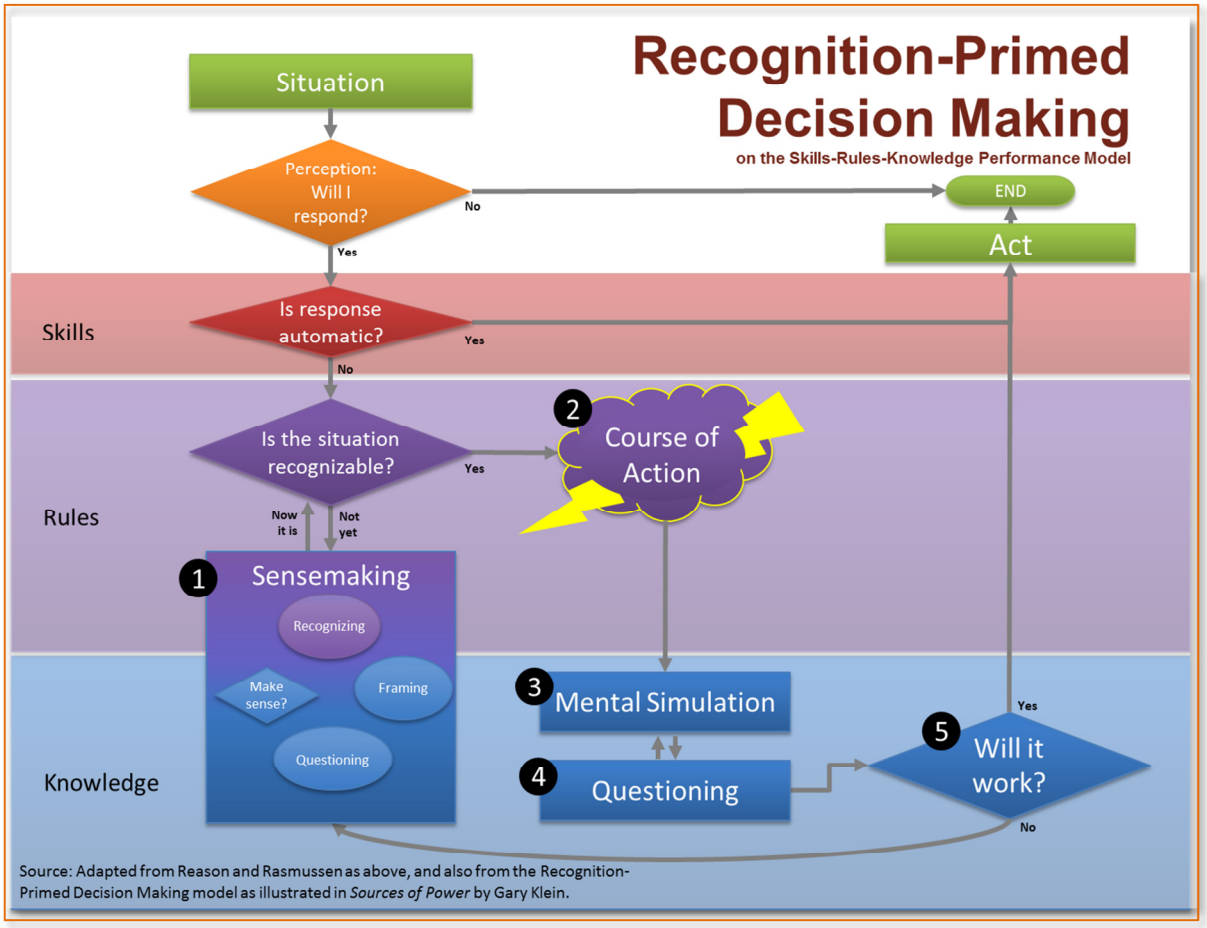
After the event, other pilots stated that this was a creative and unprecedented solution. Sully's landing on the Hudson was successful, with no lives lost and relatively few injuries sustained.

Quote source: CBS News/60 Minutes.

[3] Klein, 1998

Recognition-Primed Decision Making

Here's how RPDM works, as applied to the skills-rules-knowledge model:

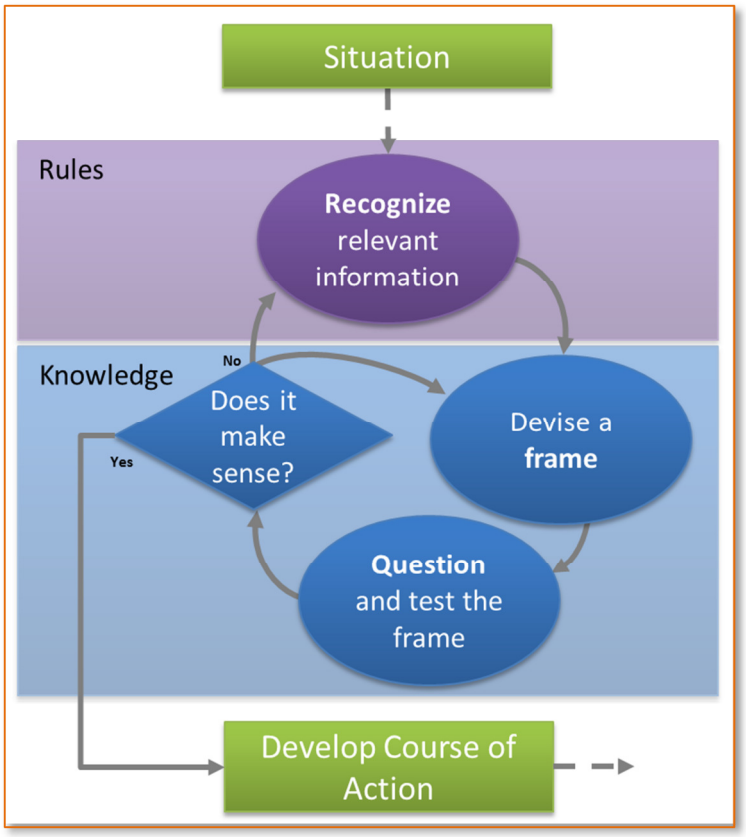


1. If the situation is not immediately recognizable, the decision maker performs sensemaking (see below) until a pattern emerges. Note that the Recognizing step of sensemaking is in rules space; sensemaking utilizes pattern recognition and intuition.
2. When a situation is recognizable, even in a novel way, then a course of action becomes immediately apparent. The key to success is that the decision maker must have enough experience to recognize and correctly interpret the patterns.
3. The decision maker simulates the course of action mentally, to check for possible surprises and predict the outcome.
4. The decision maker questions the decision, with a team if possible. (See "Questioning," later in this handbook.)
5. If it is agreed that the course of action will work, the team takes action.

Sensemaking

Sensemaking is the process by which we collect and sort out new and unfamiliar information to develop situational awareness. It involves assimilating incoming information into a frame, or likely story, which accounts for the causes and effects of what has happened. In the face of information that doesn't fit the frame, decision makers have to find or create new frames.

In general leadership, sensemaking has emerged as an essential function. It has gained the attention of military, first-responder, and business organizations. Leaders need sensemaking skills to explain changing conditions and unpredicted outcomes. In crisis conditions, sensemaking is particularly challenging because information can be conflicted or incomplete. However, as in decision making, intuition primed by experience makes all the difference. In tough situations, decision makers with deeper experience demonstrate an almost uncanny ability to put together pieces of a puzzle that novices do not even see.



Models of sensemaking vary, but they generally include these steps:

- Recognize relevant information.
- Devise a frame, or likely story, that explains what is known.
- Question, test, and adjust the frame.
- Repeat until the situation makes sense.

Sensemaking can occur in a team brainstorming session, or in one person's mind in a matter of seconds. An "aha moment" is generally the result of a sensemaking cycle in progress.

How the Decision Emerges

Once they have assessed a new situation with sensemaking, experienced people can develop a course of action intuitively and spontaneously. They decide in rules space; they are applying rules in a novel way to an unfamiliar situation.

> "A good solution applied with vigor now is better than a perfect solution applied ten minutes later."
>
> —General George S. Patton

A decision that emerges in this manner is not optimized or proven; it is "good enough." Making a "good enough" decision is also known as *satisficing*. When time is of the essence, an actionable "good enough" decision is usually better than delaying action.

Mental Simulation

During the mental simulation step, the decision-maker works out how to implement the plan, what to expect, what surprises to look for, and the possible outcomes.

Mental simulation is a common problem-solving technique. For example, in a game of chess, the player is rapidly performing mental simulations of one course of action after another.

Note that the decided-upon course of action is not necessarily the first one that pops into the decision maker's head. Mental simulation is the first test.

Quick Steps for Recognition-Primed Decision Making

As you develop the right experience, your intuition becomes more reliable during a crisis. Recognition-primed decision making leverages intuition and expertise.

1. **Recognize a good-enough course of action, based on experience.** Your experience allows you to recognize options and outcomes, even in entirely new situations. Use that experience to bring your decision-making process back into Rules space.
2. **Mentally simulate the implementation and outcome.** Run through the plan in your mind, and envision your course of action. You can intuitively fill in the details and prepare for known obstacles.
3. **Question your decision with your team or a peer.** Quickly apply checks such as those listed below. Get a new perspective and test for errors in judgment.

Questioning

> "You will often find that knowing little makes it easier to fit everything you know into a coherent pattern."
>
> —Daniel Kahneman

Only with the right experience will a person be able to apply internalized rules to a new situation. An intuitive observation or decision made by a novice is more likely to be influenced by incorrect recognition of the situation, bad assumptions and biases. By questioning the thinking process, you'll be able to tell the difference.

Both sensemaking and recognition-primed decision making include a step for questioning. Since both processes rely on intuition primed by experience, it is important to make a quick check, when possible, that the decision maker's experience is applicable and that none of the common human thinking errors are at work.

When possible, question each frame or decision with a peer or your team, using the quick checks on the **Questioning to Support Decision Making** (Handout 8 - A).

For more decision-making checks, see the **Thinking Traps to Avoid** (Handout 8 – B). These are barriers to critical thinking that you can look for in your everyday work, so that you will be more likely to spot them in a crisis.

Examples of RPDM

- At a house fire, flames are coming from the kitchen, indicating a typical small kitchen fire. Firefighters spray water on it, but it is not abating. The lieutenant has a bad feeling, and orders his crew out of the house immediately. As soon as they leave, the floor collapses. The lieutenant had intuitively recognized that the fire was much larger than it appeared, and had started in the basement.
- Nurses in a neonatal intensive care ward recognize when a premature baby has an infection, even before the infection is detectable in tests. Their ability to recommend antibiotics in a timely manner saves lives.
- During the Persian Gulf War, an officer on a British destroyer is immediately sure that a radar blip is a hostile missile, not a passenger aircraft, and he shoots it down. The officer is not sure how he knows, but he is right. Later, it is determined that the distance from the coast of the first blip, the acceleration of the blip, and the officer's understanding of Iraqi strategy all contributed, unconsciously, to his ability to make the decision.

Source: *Sources of Power* by Gary Klein

Prime Your Intuition

You already make recognition-primed decisions every day. You know the technique. To ensure your success in using it during a crisis, build up your ability to recognize solutions in unfamiliar situations. Here are some approaches that are known to develop decision-making expertise:

- **Value your training.** Appreciate how additional training prepares you for decision making, and get as much as you can.
- **Run "What If" Simulations.** During training or other time with your team, mentally simulate possible crises. Talk through consequences of the crisis, options, decisions to be made, and possible outcomes.
- **Seek out new experiences.** Take on new roles, and build your experience bank. The more you have seen and experienced, the more information will be at your disposal when you need it.
- **Follow-up on feedback.** Make changes when changes are indicated, to grow professionally and to increase your resilience.
- **Know your people.** Many decisions are people decisions. Know the skills and strengths of the people on your team so that you can communicate easily and assign roles and tasks appropriately under pressure.
- **Know the OE.** By learning from operating experience, you will be able to apply lessons learned to future challenges.

Crisis Leadership

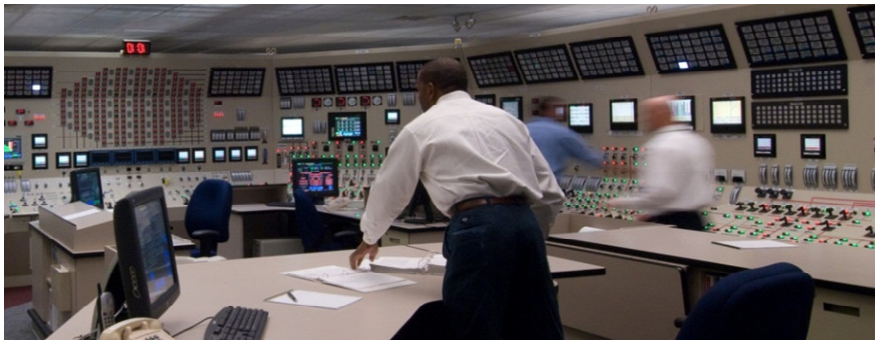
The leadership skills for achieving the Essential Outcomes (INPO 15-005) in a crisis are somewhat different from those required in your daily work. Because a crisis can be volatile, uncertain, complex, and ambiguous, neither you nor your team members can fall back on the usual procedures and rules. Instead, you will rely on your experience and judgment to devise new courses of action, and your team members will look to you for leadership.

A crisis can be volatile, uncertain, complex, and ambiguous.

Crisis leaders must be ready to:

- **Lead in resistance to stress:** Manage stress, lead people who might be under the influence of the stress response, and help them manage their own stress.
- **Lead in the face of volatility:** Be ready to handle course corrections, and interpret new information in a volatile environment.
- **Lead with effective communication:** Be precise and candid to earn the trust of others.
- **Lead with priorities and values:** Be prepared to make difficult decisions and stand by them.
- **Lead without criticism:** Under extreme conditions, acknowledge human limitations.

In this section, we will discuss the skills and tools of crisis leadership as we tie together the major concepts of this course. For a summary, see the **Crisis Leadership Tools** (Handout 9).



Lead in Resistance to Stress

Use what you know about the effects of stress as a tool for better leadership.

Start with Your Stress

On airplanes, they say, "Put your oxygen mask on first before assisting others." It is imperative that you take care of yourself first so that you maintain the fitness and competence to lead. Don't take your own ability to manage stress for granted.

- **Use the tools for yourself.** In particular, slow down your speech and your breathing, relax your body, and smile when you can.
- **Project calmness.** This is your responsibility as a leader. A calm leader has a calming effect on the people they lead. In a crisis, you want calm, so you must be calm.
- **Get a personal peer check.** Find someone you trust to be honest and up front with you. Ask them to tell you what stress responses they observe, and whether you are projecting calmness.

Help Others under Stress

The **Stress Treatment Tools** (Handout 5) includes several tools that you can use to help others. Different tools will work for different people in different situations. Remember that each person has his or her own stress response.

Encourage the "buddy system" and personal peer checks for physical and cognitive stress symptoms.

Relieve Stress on the Scene

- **Encourage breaks**, and take them yourself. Even if you can't leave the control room, stand, stretch and stop work for a minute. Replenish energy to help keep yourself and others as close as possible to the "optimum performance" zone.
- **Rotate workers** from high-stress to low-stress functions if you can. This will increase people's endurance.
- **Improve the work environment** whenever possible. Don't underestimate the effects of the physical environment on stress and risk. Also, remember that what one

person can tune out (such as an alarm), another person might react to in a negative way that increases risk of error.

Lead in the Face of Volatility

As you implement courses of action in a crisis, remember that conditions are changing. Be ready for frequent course corrections:

- **Set short-term goals.** Use incremental objectives to demonstrate progress and maintain momentum.
- **Reassess frequently.** Actively look for surprises and adjust the course.
- **Be flexible.** Welcome new information and perspectives that might challenge your current frame. Don't cling to a frame that might be invalid.
- **Keep moving forward.** Don't let a setback defeat you. Draw on your resilience and emotional intelligence, take on the next challenge, and repeat the sensemaking process.

To build flexibility into your crisis response, think of it as an iterative, looping process, in which you continually make sense of your situation, adjust as needed, act, and repeat. (See "The OODA Loop.")

The OODA Loop

The OODA loop is method for responding rapidly in a volatile environment. It was developed by Colonel John R. Boyd, a fighter pilot in the U.S. Air Force. He developed this method for making faster moves in air-to-air combat:

- **Observe:** collect all relevant information available.
- **Orient:** establish an understanding of the current situation.
- **Decide:** devise a course of action.
- **Act:** execute the decision.

During combat, Boyd would repeat the OODA loop in rapid succession to react quickly and persistently.

Sources: Higgins 2013, Thompson 2010

Conduct Briefs Frequently

Conduct frequent briefs to gather new information and assure people that they are well informed. Remember that people will be more stressed if they feel like they don't know what is going on. (See "Effective Briefs: The Four Ps." This template also works well in one-on-one conversations.)

Lead with Effective Communication

> "Plans are worthless, but planning is everything. The very definition of 'emergency' is that it is unexpected, therefore it is not going to happen the way you are planning."
>
> —Dwight D. Eisenhower

When you are communicating with your team during a crisis, keep in mind that each person, including yourself, is coping with a stress response. Take a different approach than you would under normal circumstances.

Use HU Tools

Rely on human performance (HU) tools with greater care during a crisis. These will help mitigate stress effects, and reduce risk.

Frequently, 3-way communication is the first thing to slip in an emergency. If you notice this happening, correct it immediately.

Placekeeping and verification are critical during an emergency, but too easily overlooked when under stress. Watch for slips and correct them immediately.

Communicate Precisely

Remember that you are competing with stress for the attention and concentration of your team. Repeat information as needed.

- Address individuals by name or position.
- Have team members look you in the eye as they repeat back instructions.
- Be sure they understand their roles well, and repeat instructions as necessary.
- Be patient with a person who has trouble understanding or remembering what you are saying, due to their own stress response.

Ask for Relevant Information

Ask your team for precise and relevant information. In an emergency, people will tend to over-communicate the details. Ask the team to evaluate the situation, determine what is and isn't relevant, and provide that information to you.

State Your Intent

In a crisis, giving a person a task is not enough. It is critical to explain the intent and expected outcome of the direction you provide.

Once members of your team understand your intent, you can delegate the authority to adjust the plan as new information and events come up. In this manner, your team will be able to adapt to volatile conditions without stopping to defer to you.

Be Candid

Whether communicating to your team or others outside the station, remember that it is acceptable not to know everything. As New York Mayor Rudolph Giuliani demonstrated during the 9/11 crisis, it builds trust and confidence to admit what you know or do not know, and communicate frequently as information comes in.

In contrast, during the Fukushima crisis, Japanese Prime Minister Kan unnecessarily changed the size of the evacuation zone several times, and thus appeared to be either hiding or changing his mind about the seriousness of the situation. He could have gained the trust

Effective Briefs: The Four Ps

Use the Four Ps as a template for an effective staff brief.

Past: Describe the events that resulted in the crisis condition. Provide the staff with a review of the event-initiating conditions, or, if these are well known, any significant changes that have occurred since the previous brief.

Present: Summarize the current plant status, including an overview of the currently implemented procedures and event response strategies. Bring all staff members up to date, and highlight your current areas of focus.

Plan: Explain upcoming, planned, or forecasted evolutions and procedures to be implemented. Generally describe staff duties so that the entire team understands how the plan will be implemented and what success looks like. Discuss only information that is relevant to all attendees. Later, brief individuals on specific duties.

Poll: Ensure that each staff member understands the information communicated. Then, allow each staff member to ask questions and provide any additional pertinent information. Make sure each staff member knows the intent of the plan, so that they will be able to adapt to changing conditions and still support the objective.

Under stress, it might be useful to rely on a simple template like this one.

Source: Monticello Nuclear Generating Plant. "Operating Procedure Standard OWI-01.03"

of the people by admitting that complete information was not yet available, and that the situation was evolving.

Lead with Priorities and Values

Take Stock before a Crisis

Priorities and values reinforce your ability to be decisive. They are guideposts you can rely on when decision making is difficult in the moment. Your reliance on well-defined priorities and values will also inspire and motivate others.

To help avoid difficult dilemmas under stress, take stock of your personal values before a crisis occurs. Writing a personal credo is a powerful exercise. (See "Define Your Values.")

Define Your Values

To establish what is truly important to you before a crisis puts you into an ethical dilemma, write a personal credo.

The credo consists of statements that begin with "I will always" or "I will never." Here are some examples:

Value	Example Decision
I will never knowingly make a statement or set an example that would erode the safety culture at my station.	Would I risk my own safety, and perhaps the safety of others, by taking a risky action that will stabilize the reactor sooner?
I will always put my responsibility for the health and safety of the public above my responsibilities to my family.	During a dangerous storm, I am leading our FLEX coping strategies. I have just learned that my house has collapsed with my family inside. Would I leave?

Establish Priorities Early

Within the crisis environment, establish priorities early and communicate them to the team. Let people know when you are making a difficult decision because it is the right thing to do. Communicating priorities will help ensure that if people need to improvise under volatile conditions, their own decisions will be in line with the priorities and the goal.

> "Knowing your values is the only way you can ensure that you're the one who is making the decision about what gets lost, and what is too important to sacrifice."
>
> –James Lee Witt

Lead without Criticism

When you see individuals exhibiting stress symptoms and not managing them well, withhold criticism and judgment. Help them acknowledge that their reaction is natural and normal.

- Remind them that they are not overreacting, weak, or mentally ill. They are under the influence of stress hormones.
- Alleviate any guilt they might be feeling due to errors (whether real or imagined), or from thinking they didn't do enough.
- If they have made errors, and learning will not help the current situation, save the coaching and correcting for after the crisis.

In the same fashion, when you and your leadership team are faced with difficult decisions or unfortunate outcomes, withhold criticism on yourselves. By taking action decisively in the face of uncertainty, you are doing your best work.

Thoughts on Leadership from Fukushima Daini

From a presentation by Naohiro Masuda, Site Superintendent of the Fukushima Daini Nuclear Power Plant at the time of the crisis.

Command and Control:

- Leader takes full responsibility for command and control.
- Specific instructions should be delivered clearly to each sub-leader.
- Leader should express in words both understanding of and gratitude for reports from members.
- As soon as members seek direction, leader should quickly respond to them.
- Critical decision-making and changes in policy should be conducted after receiving unanimous approval for them.
- Leader should reprimand members if they did not perform their tasks as instructed, and console them if the task they were instructed to perform did not go to plan.

Information to Share with your Team:

- Plant-related information
- Concerns
- What is happening
- How much longer efforts need to be made and whether the situation is getting better or worse
- Areas considered dangerous from a personal safety perspective
- Sharing plant conditions with local communities

Overall:

- What matters is to work as a team: Team and members should be motivated and inspired.
- The leader is the only person who can oversee the team in its entirety: Situation awareness is crucial.
- Information management should be centralized.
- The aim of decision-making should be to achieve goals.
- Safety of personnel should be given top priority, but personnel should be prepared to engage in high risk work if this becomes necessary.
- What should be done, which task should come first and how things will work should be clearly indicated to the team to enable them to perform tasks efficiently with limited time and manpower.

Source: Masuda, 2014

It's Up To You

A crisis is an event that's unknown, so no one can train you on what to do—only on how to become more adaptable in the face of the unexpected. In this course, we discussed the techniques that other crisis decision makers use, and the skills they draw upon in a crisis. The real training is up to you. Only you can:

- Build your stress tolerance and resilience through daily practice.
- Reduce your routine stress, so that you have more capacity for coping with stress in an emergency or crisis when you need it.
- Be healthy to lessen the effects of stress on your body.
- Build your experience so you can recognize viable courses of action in unfamiliar circumstances.
- Practice recognition-primed decision making during activities that are not procedure-driven.
- Know your people and their strengths, so that you can call on their talents when needed.
- Clarify your values to ease the strain of making difficult decisions.
- Study techniques and cases of crisis leadership beyond the scope of this course.

Complete Your Action Plan

Your **Crisis Decision Making for Nuclear Leaders Action Plan** (Handout 2) is a critical component of this course. Accomplishing the learning objectives of this course requires application and practice. Complete your action plan, and refer to it often, to prepare yourself for leadership and decision making in the face of crisis.

> Courage is not the absence of fear, but the triumph over it.
>
> —Nelson Mandela

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Recommended Resources

High Performing Systems, Inc., ARSENAL™ online assessment for stress resilience: http://www.hpsys.com/Assessments_ARSENAL.htm

Empatica, Inc. “Monitoring the Autonomic Nervous System”: https://www.empatica.com/science

Course Handouts

On the following pages are copies of the handouts used in the course.

Learning Objectives

Given your role as an emergency responder, the terminal objective of this course is that you will understand and apply tools that support effective decision making under crisis conditions. Some of these tools are also described in the generic advanced FLEX course.

In support of this objective, this course contains the information you need to:

1. Define stress and describe its effects on the brain and body.
2. Describe how stress resilience and tolerance affect your ability to perform under stress.
3. Apply tools for recognizing, checking and controlling the effects of stress for yourself and others.
4. Contrast rational and intuitive decision-making methods and their applications.
5. Discuss methods that support effective decision making during crisis conditions.
6. Describe the influences of emotions on leaders during a crisis.
7. In a simulated nuclear plant crisis event, apply methods for decision making under stress using the concepts and methods presented in this course.

Notes

Crisis Decision Making for Nuclear Leaders

Action Plan

The real training is up to you. The impact of this course depends on what you do afterwards.

Effects of Stress

Increase awareness of my personal stress response.

Apply tools for mitigating the effects of stress.

Stress Training

Build my stress tolerance to handle more demand without negative stress.

Build my stress resilience to perform better in stressful situations.

Decision Making Under Crisis

Build my experience and expertise to improve my ability to recognize solutions.

Practice recognition-primed decision making when in an unfamiliar situation.

Crisis Leadership

Practice the leadership approaches and tools that are effective in a crisis.

Notes

Stress Response Checklist

Each person has different responses during a stressful situation. What are yours? This document is personal and will not be shared. You can also use this list to identify stress responses in others.

	Physical Symptoms	Cognitive and Emotional Symptoms
NEGATIVE	☐ Sweaty palms ☐ Dry mouth ☐ Rapid heart rate and breathing ☐ Heart palpitations ☐ Light-headedness ☐ Increased perspiration ☐ Restlessness; need for activity (pacing) ☐ Trembling ☐ Nervous tics ☐ Butterflies ☐ Gastrointestinal distress ☐ Appetite change, craving for sweets ☐ Craving for caffeine, nicotine, alcohol ☐ Tunnel vision ☐ Muscle tension ☐ Speaking loudly or softly ☐ Others: _____ _____ _____ _____ _____ _____ _____	***"Fight" Response*** ☐ Anger or shortness of temper; aggressive behavior ☐ Hypervigilance (inability to change approach to a problem) ☐ Worry, preoccupation with situation ☐ All-or-nothing thinking ☐ Blaming or over-controlling others ***"Flight" Response*** ☐ Drawing a mental blank or difficulty getting words out ("choking") ☐ Inability to focus on a task or conversation; confusion ☐ Acting "scattered:" changing one's mind often ☐ Inability to recall facts that would otherwise be memorized ☐ Withdrawal from others or dissociation from surroundings ☐ Immersion in busy-work; avoidance of priorities ☐ Edginess, increased startle response ☐ Crying easily ☐ Others: _____ _____ _____
POSITIVE	☐ Increased strength ☐ Exhilaration ☐ Increased physical endurance ☐ Relief from chronic pain ☐ Others: _____ _____ _____ _____	☐ Increased attention to detail ☐ Increased problem-solving ability ☐ Confidence ☐ Ability to focus on priorities ☐ Others: _____ _____ _____ _____

Notes

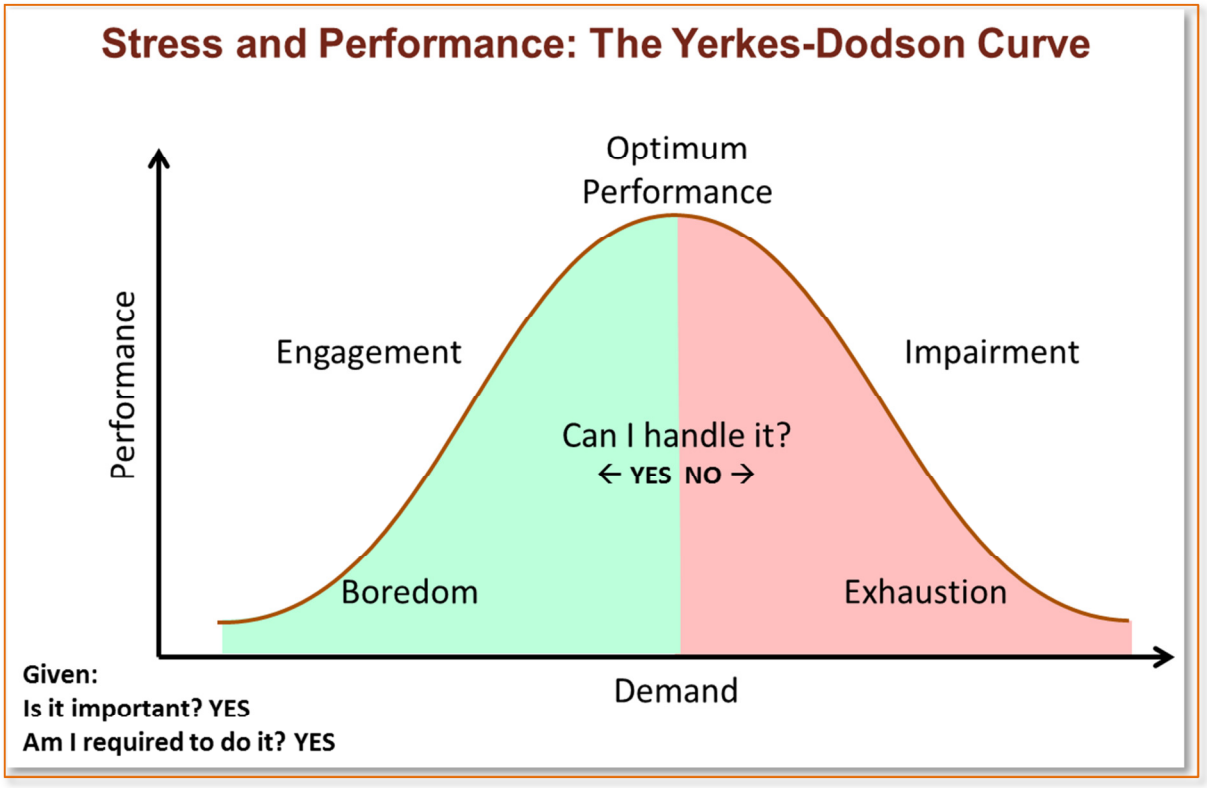
Definition of Stress

1. Is it important?
2. Am I required to do it?
3. Can I handle it?

If the answer to all three is "yes," there is negative (bad) stress.

Stress and Performance

Stress can also be positive. When does stress go from good to bad? When the answer to "Can I handle it?" goes from "yes" to "no."



Empatica Wrist Monitor Data

Here are descriptions of the types of data recorded by the Empatica E4 biofeedback monitor.

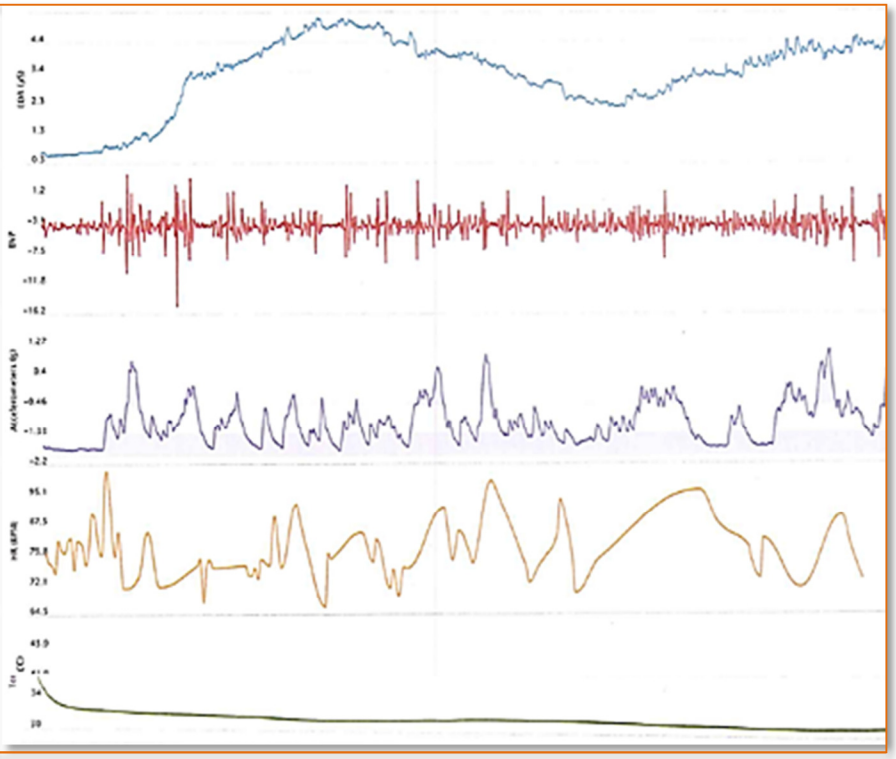
EDA=Electrodermal Activity
Indicates stimulation of the sympathetic nervous system.

BVP=Blood Volume Pulse
Indicates changes in heart rate

Accelerometer: *Captures motion-based activity*

HR (BPM)=Heart Rate (beats per minute) Calculated from BVP.

Temp (°C)



Stress Treatment Tools

Use these tools, and recommend them to others, to treat stress symptoms during a crisis.

Tool	Description
Control your breathing	Controlled breathing is the most effective tool for reducing stress, because it sends signals back to *both the stress and relaxation centers* of the brain to regulate stress symptoms. One simple exercise is to breathe in for four counts, and out for four counts. To increase relaxation, increase the counts.
Slow down	Consciously slow down your speech and other movements to calm yourself and others.
Smile and laugh	Smiling and laughing have many physical benefits, including stimulating endorphins, reducing cortisol (stress hormone), relaxing muscles and slowing the heart rate.
Chunk information	Break down big tasks or large amounts of information into smaller, more manageable chunks, and then take one at a time.
Snap a rubber band	Snap a rubber band on your wrist to "snap back" to the task at hand.
Count	Count from 1 to 10, or count to 100 by threes, to stimulate the logic centers of the brain.
Exercise	Stretching or cardio can interrupt the stress response in the muscles, and reset the pace of breathing.
Take breaks	Take a break, even if only to stand and stretch in place, to calm the mind and body. Take a few moments to practice focusing your mind and regulating your breathing.
Change the environment	If possible, go to a place with different temperature, air quality, sound and/or lighting. After intense work at a computer screen, focus your eyes on an object in the distance.
Relax	Repeat a focus word or sound while progressively relaxing all muscles from head to toes.
Take a power stance	Taking a confident stance for two minutes is scientifically proven to decrease stress hormones.
Warm your hands and face	Rub hands together until friction makes them hot, and place them over your face and eyes. Take a deep breath through your nose and relax as you exhale through your mouth. Also, try washing hands in warm water or holding a hot cup of coffee.
Take appropriate medications	As needed, take pain relievers (over-the-counter or as prescribed and acceptable within your fitness-for-duty program) if pain or tension is your stress response. Don't risk experimenting with new medications during a crisis. Don't neglect to take any prescription medications you use normally.
Eat and drink	Caffeine can help combat fatigue, but use carefully to avoid stimulating your stress response. Sugary foods can provide a rush of high energy followed by a period of low energy. Use carefully, especially if cravings are part of your stress response. Do not use alcohol. Aside from being a violation of your fitness-for-duty program, it will slow down your reflexes and impair your thinking at a time when you need to be in top form.
Self-check and peer-check	Take a mental step back and observe your emotions. Are they guiding you or overwhelming you? Are they appropriate to the stressors? Ask a trusted colleague for their observations.
Withhold criticism	Allow yourself and others to have the stress response they have: it is an involuntary reaction. Save coaching and feedback for after the crisis if possible.

Notes

Stress Training Checklist

Build Stress Tolerance: *Handle More.*

Tool	Description	Doing It	Will Try It
Train, train, train	Train well and often to build the skills you will need in an emergency or crisis. Emphasize the value of training to the people you lead.		
Nudge your comfort zone	Push your stress tolerance threshold by small amounts over time. Take on new responsibilities or try challenging activities.		
Conserve your stress response	Stress accumulates. Lots of little stressors can build up to a serious stress response. Save your physical and mental ability to cope with stress for the issues that really matter.		
Stay organized	Stay up-to-date with your finances, home and car maintenance, family commitments, and other common stressors.		
Ask for help	Ask for help with tasks that add unnecessary stress to your life. For example, if you don't enjoy mowing the lawn, hire someone to do it. At work, delegate whenever possible.		
Adjust your perceptions	Remember, stress is all about perception. Is it important? Are you required to do it? Can you handle it? Try changing your perception of any one of these questions.		
Plan ahead with your family	Talk to your family about your responsibilities in case of a crisis. Devise multiple alternatives for your loved ones to communicate with you, team up with other families, and evacuate or take shelter.		

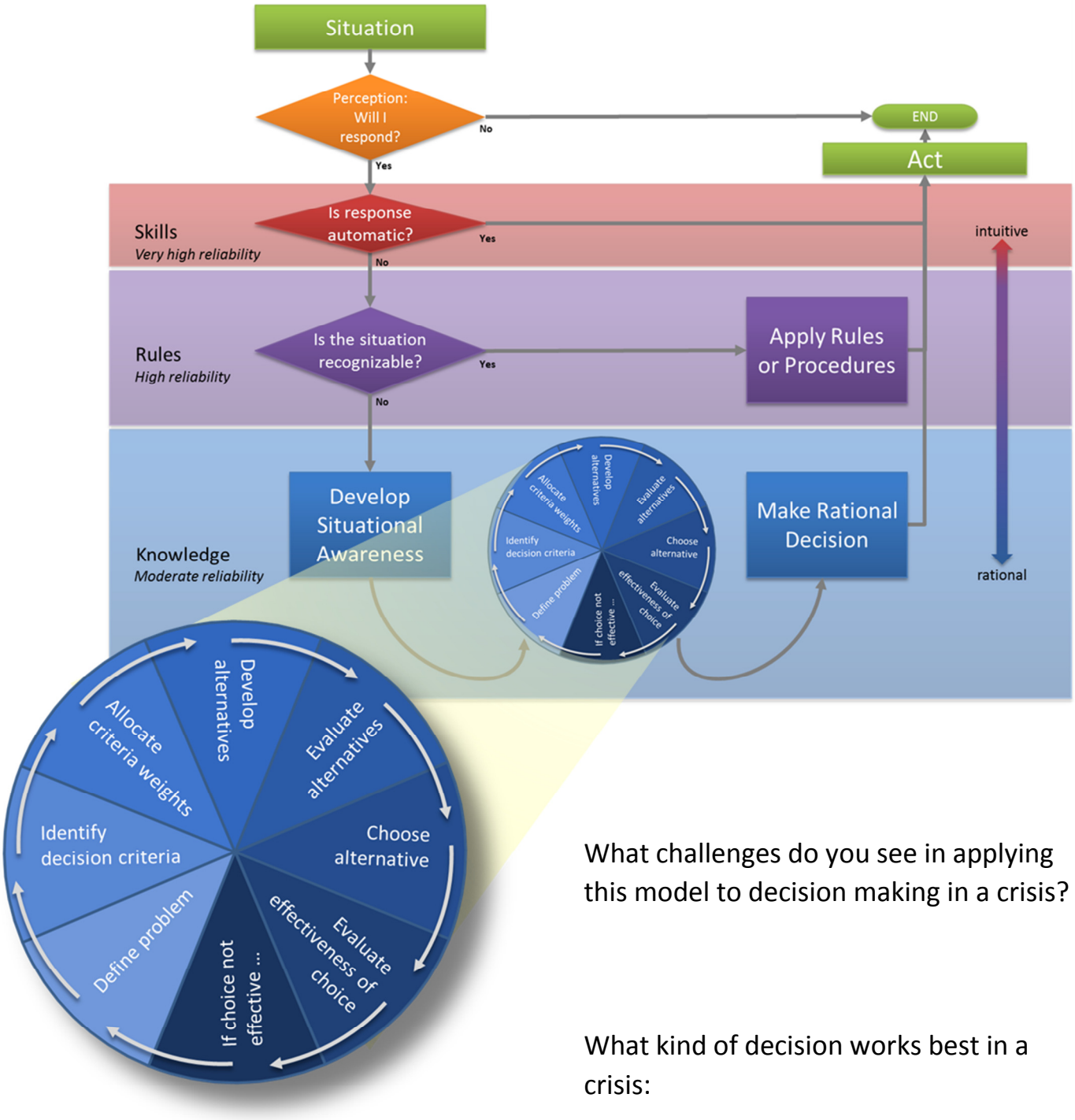
Build Stress Resilience: *Perform Better.*

Tool	Description	Doing It	Will Try It
Focus the mind	Practice controlling your mind to focus on the here and now, to build the brain's resistance to stress and perform better in spite of distractions. Focus also improves your productivity every day.		
Practice self-regulation	Develop the mental toughness to keep disruptive emotions and impulses in check, and make difficult decisions that are aligned with priorities and values.		
Establish your support network	Build your connections with family and friends. Remember that people with social support live longer and healthier lives.		
Be a life-long learner	Keep your brain in shape as a life-long learner with classes, hobbies, reading, travel, puzzles, and good conversation.		
Cultivate a positive attitude	Practice realistic optimism, a drive to action, and taking responsibility for your results.		
Value your health	You already know the benefits of good sleep, nutrition, and exercise. Take your health seriously. Use your wearable fitness tracker to watch for changes in heart rate and other sympathetic responses during the day.		

Notes

Decision Making: A Traditional View

This diagram illustrates how decision making is traditionally prescribed.

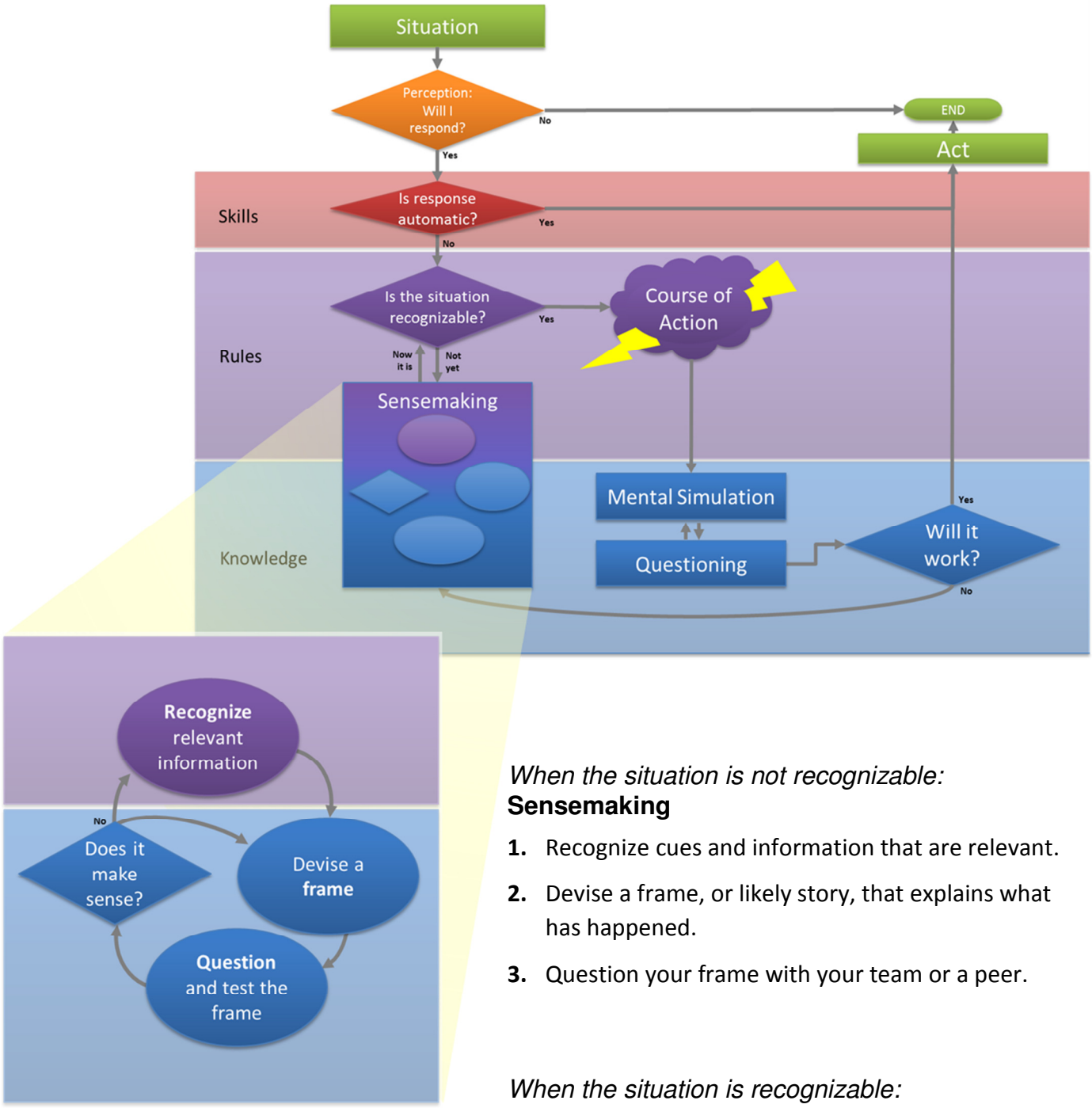


What challenges do you see in applying this model to decision making in a crisis?

What kind of decision works best in a crisis:

- Intuitive or rational?
- Skills, rules, or knowledge?

Recognition-Primed Decision Making



When the situation is not recognizable:
Sensemaking

1. Recognize cues and information that are relevant.
2. Devise a frame, or likely story, that explains what has happened.
3. Question your frame with your team or a peer.

When the situation is recognizable:
Recognition-Primed Decision Making

1. Recognize a good-enough course of action, based on experience.
2. Mentally simulate the implementation and outcome.
3. Question your decision with your team or a peer.

Questioning to Support Decision Making

Seek	Avoid
Facts	**Wishful Thinking**
Develop situation awareness from facts (even incomplete facts) rather than from unverified reports or wishful thinking.	
Experience	**Overconfidence**
Solicit input from people with the most applicable experience and training. Remember that experience, not confidence, correlates with success in decision making.	
Perspective	**Bias**
Assign a Devil's Advocate or solicit diverse points of view on the problem and its solution. Consider that people tend to filter information to confirm their existing beliefs. Use differing perspectives to interpret new information objectively.	
Possible Outcomes	**Getting Stuck**
Know the "what ifs." Encourage the team to anticipate a range of possible outcomes, and to prepare for changes. Avoid getting stuck looking for a risk-free option, especially if there is greater risk in inaction.	
Challenges	**Groupthink**
Ask the team to challenge assumptions. Check for alignment with prioritized goals and the team's capabilities. Work actively to ensure that no one feels shut down, is withholding information, or is "along for the ride."	
Positive Stress	**Negative Stress**
Know your team and monitor for signs that their stress tolerance is overloaded. Challenge or otherwise address emotional and impulsive thinking that is an indication of negative stress.	

Thinking Traps to Avoid

When faced with the pressure of a crisis, decision makers are particularly susceptible to these traps.

Altered Perspectives

Framing: Be sure that your overall understanding of the situation, or frame, is not limited by your own experience or perspectives. Be prepared to "think outside the box."

Anchoring: The first piece of information we receive about a new situation is known as the anchor because we tend to fit additional information to the anchor. Anchoring can cause you to miss or misinterpret new information.

Overconfidence

Underestimating the problem: Neglecting to assess a crisis in a timely manner can cost valuable time. Don't assume that you and your team have a situation under control before you have the facts.

Excessive optimism: Be realistic about your chances for success. Too much optimism can cause you to miss new information that doesn't happen to fit your desired outcome. Remember: "Hope is not a strategy."

Resistance

Information bias: To support a difficult decision, we tend to demand more and better information before deciding. Be careful of unnecessary delays, especially in a situation where complete information might never be available.

Risk aversion: In a crisis, many decisions carry risk. Be careful of delaying or avoiding action with the hope of eliminating risk. It is usually better to act.

Hypervigilance: If a course of action is not working, act swiftly to change the plan. Don't cling to a plan that isn't working in hopes that the results will change.

Organizational Biases

Sunflower reflex: When you are tempted to ask, "What would the boss do?" be sure that you are not unnecessarily deferring a decision that you need to make yourself.

Champion bias: We naturally give more credence to the opinions and decisions of strong leaders. Verify that the leader's expertise is truly applicable to the current situation.

Groupthink: Team members might withhold potentially important information to avoid conflict, or if reporting it is outside their role. Give members on your team permission to speak out on anything they believe is important.

Information Pathologies

Compelling stories: Interesting explanations for events stand out in our minds. Don't confuse an interesting possibility or experience for the situation at hand.

Recent events: Similarly, we tend to give more recent experience greater weight than older experiences, regardless of their relevance.

Confirmation bias: We tend to search for and accept only the information that confirms our current frame. Actively seek out new information that disproves your understanding of the situation.

What You See Is All There Is (WYSIATI): We tend to consider only the data and information that we can see, which might rule out other potentially important information.

Practice looking for these decision-making derailers routinely, and you will be prepared to avoid or mitigate them during a crisis.

Source: Higgins and Freedman, 2013

Recommended Reading: *Decisive: How to make better choices in life and work* by Chip and Dan Heath

Crisis Leadership Tools

Crisis leadership is different from everyday leadership. Here are techniques for leading a team under extraordinary conditions.

Lead in resistance to stress	
Start with your stress	Use the Stress Treatment Tools. Make sure you are ready before you help and lead others.
Project calmness	Model the calmness and focus you want from the team. • Slow down your speech and breathing. • Relax as much as possible. • Smile.
Get personal peer checks	Ask a peer: • What are my observable stress responses? • How able am I to focus and problem-solve? • How well am I projecting calm?
Help others under stress	Recommend stress reduction techniques to others based on their individual stress responses.
Implement personal peer checks	Ask the team members to look out for one another by asking: • What are my peer's observable stress responses? • How able is my peer to focus and problem-solve?
Encourage breaks	Remember to take breaks yourself, even if just to stand and stretch.
Rotate workers	Rotate between high-stress to low-stress functions to increase endurance.
Improve the work environment	When possible, mitigate environmental stressors such as noise, temperature extremes, odors and lighting. Remember that some people can't tune out distractions as well as others.
Lead in the face of volatility	
Set short-term goals	Use incremental objectives to demonstrate progress and maintain momentum.
Reassess frequently	Actively look for surprises and adjust the course.
Be flexible	Welcome new information and perspectives that might challenge your current frame. Don't cling to a frame that might be invalid. Think of your response as an iterative, looping process.
Keep moving forward	Don't let a setback defeat you. Draw on your resilience and emotional intelligence and repeat the sensemaking process.
Conduct briefs frequently	Use the 4Ps when communicating the course of action to your team: • Past: Here's what has happened. • Present: Here's the situation now. • Priorities: Here's what we must do and why. • Poll: What do you think? What do you need?

continued on reverse

Crisis Leadership Tools

continued

Lead with effective communication	
Use HU Tools—don't let them slip	• Emphasize 3-way communication. • Remember placekeeping and verification.
Communicate precisely	• Address individuals by name or position. • Request people stop and look you in the eye. • Verify that team members understand roles and tasks. • Be patient with a person who has trouble understanding or remembering what you are saying.
Ask for relevant information	Get precise and relevant information without over-communication. Let others know what is relevant.
State your intent	Explain the intent and expected outcome of the direction you provide. In this manner, your team will be able to adapt to volatile conditions without stopping to defer to you.
Be candid	Remember that it is acceptable not to know everything. Rather than give false information, build trust by admitting that the situation is evolving.
Lead with priorities and values	
Take stock before a crisis	Use a personal credo to establish what is truly important to you before a crisis puts you into an ethical dilemma.
Establish priorities early	Ensure that if people need to improvise under volatile conditions, their own decisions will be in line with the priorities and the goal.
Lead without criticism	
Withhold criticism of team members	• Acknowledge that the stress response is normal. • Alleviate guilt. • Save coaching and correcting for after the crisis if possible.
Withhold criticism of yourself	Remember that by taking action decisively in the face of uncertainty, you are doing your best work.

Case Study Worksheet

The success of bringing the four units at Fukushima Daini to cold shutdown after the earthquake and tsunami was a triumph of crisis leadership. Below are descriptions of several points during the crisis where leadership made a difference. Discuss how you would apply crisis leadership in the same situation.

For each situation, consider the following approaches. Each approach is described in detail on the **Crisis Leadership Tools Job Aid**.

- **Lead in resistance to stress**
- **Lead in the face of volatility**
- **Lead with effective communication**
- **Lead with priorities and values**
- **Lead without criticism**

Situation 1. Set Direction

Friday evening, after the earthquake and two-hour tsunami, a tsunami alert remains in effect, and aftershocks continue.

Night has fallen and most of the station has lost power. The property is flooded and strewn with debris, and there is risk of radiation exposure outside.

People are afraid to leave the emergency response center. However, the logical next step is to direct members of the staff to perform walkdowns and damage assessments on all four units.

How will you convince them to go?

Situation 2. Maximize Competence

By 02:00 Saturday, teams report that Units 1, 2, and 4 have lost key cooling. Two of three EDGs are operational at Unit 3. Only one operable off-site power source remains. Providing power to all units appears to be an impossible task, but you and your plant leaders develop an ambitious plan, requiring your staff to wind 5.5 miles of cable into 200-yard, 1-ton lengths. They will have to do in one day what would normally be accomplished in a month.

How will you communicate this plan to your team?

continued on reverse

Case Study Worksheet

continued

Situation 3. Engage the Workforce

After more than 24 hours under stress, without sleep, and with limited food and water, crews are winding and laying heavy cable using mostly their own physical strength.

At 15:36 on Saturday, March 12, an explosion occurs at Unit 1 at Fukushima Daiichi.

Evacuations are ordered within a 20km radius of Daiichi, which includes homes of 80% of the Daini staff. Staff members are starting to receive news—some of it very bad—about the safety of their families and homes.

How will you maintain trust and keep people motivated to do this critical work?

Situation 4. Cope with Risk

By early morning on Sunday, it becomes clear that there is not enough time to lay the cable from the radwaste building to Unit 2, which is highest priority, and to Unit 4, which is most remote. Despite some risks, you must direct your staff to abandon their current work, and connect the generators in Unit 3 as a power source for the other units.

How will you engage diverse perspectives to inform your decision while ordering a major change to the plan?

Situation 5. Achieve Sustainable Results

Sunday evening, time is getting short. What's more, pressure begins rising unexpectedly in Unit 1, making it the higher priority over Unit 2. It is a matter of hours before Unit 1 will exceed its maximum pressure threshold. Some of the painstaking work at Unit 2 is wasted, and the danger to the staff is increasing.

How will you keep people focused on their tasks as their physical energy wanes and their personal risk increases?

Epilogue

Just before midnight on the evening of Sunday, March 13, the cabling to Unit 1 is complete. Other cabling is completed the following day. All units are in cold shutdown by 07:15 on Tuesday, March 15, less than 4 days after the initial earthquake.