Course 3 - Risk and Resilience Management – Module 1

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1.1 Utility Risk and Resilience Certificate Program:

Notes:

Welcome to the third course of the American Water Works Association's Utility Risk and Resilience Certificate Program. Course 3, Risk and Resilience Management of Water and Wastewater Systems

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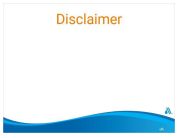
1.2 Disclaimer



1.3 Acknowledgements

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1.4 Acknowledgements

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1.5 Course 3 Purpose

Notes:

Course 3 consists of four modules and will provide participants with an awareness-level understanding of the J100 Risk and Resilience Assessment methodology. This is an AWWA standard for conducting water and wastewater utility Risk and Resilience Assessments. Course 3 will:

- Show how J100 can be used to facilitate compliance with AWIA requirements
- Help participants understand the expected output from a J100 risk and resilience assessment.
- Share strategies for prioritizing risk mitigation measures.
- Show how risk and resilience assessment results can inform the development of an Emergency Response Plan

Photo Source is Linda Warren

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1.6 Utility Risk & Resilience

Notes:

This is the third in a series of courses for the AWWA Utility Risk and Resilience Certificate Program. As the slide illustrates, the Certificate Program is designed to help participants understand how to build a Risk and Resilience strategy; and to assess, prepare for, and mitigate risks. This course will focus on the "assess" portion of the process.

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1.7 Agenda

Notes:

This graphic provides some perspective of where this course fits into the overall Risk and Resilience Certificate Program and shows the various Water Sector Voluntary, Consensus Standards that are available to help utilities develop and implement Risk and Resilience strategies. This course will review the ANSI/AWWA J100 Methodology for Risk and Resilience Management. Following a few background slides, the course will consist of four modules:

- An Overview of the J100 methodology
- Developing and prioritizing Threat - Asset Pairs
- Calculating Baseline Risk, and
- Managing Risk & Resilience

(Picture source: Morley, "AWWA 2018 12 14 AWIA Update", ppt slide 12)

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1.8 Background

Notes:

Before we get into the detailed discussion of J100, let's first review some background.

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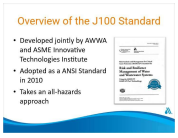
1.9 Overview of the J100 Standard



Notes:

J100 was first adopted as a Standard in 2010. The purpose of the J100 standard is to enable water utilities to make sound decisions when allocating scarce resources toward reducing risk and improving resilience. The standard establishes the requirements for all-hazards risk and resilience analysis and management for the water sector. It provides methodology and resource materials that can be used for addressing these requirements. The standard provides a process for defining risk as a function of consequences, vulnerabilities, and likelihood of man-made threats, natural hazards, and dependency and proximity hazards. By following this standard, Water Sector utilities can consistently evaluate and support risk reduction and resilience improvements.

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1.10 Overview of J100

Notes:

This is the risk equation used in J100. It basically says that risk is a function of consequence, vulnerability, and threat likelihood. Consequence is expressed in terms of dollars, vulnerability is unit-less, and the units of threat likelihood are per year. As a result, risk is expressed in terms of dollars per year. We'll be spending a lot of time in this course drilling down into the various components of this equation.

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1.11 J100 Provides

Notes: Consistency and Comparability depend on common elements. J100 provides a uniform risk/resilience analysis methodology that provides common terminology, metrics, processes, and scenarios, and consistent results. These attributes provide for comparability between initial and repeat assessments and are essential for informed allocation of limited resources.

The J100 process is not intended to be the most comprehensive and detailed risk assessment methodology - but it is intended to be

- Practical and efficient to apply,
- Cumulative over time, and
- Effective in enhancing security and resilience.

The J100 process actually seeks to avoid unnecessary or impossible detail in order to quickly and efficiently guide management decision-makers to address the highest priority risks.

Because J100 is quantitative, objective, and transparent, it can be used over time to assess progress, inform accountability, and identify changing threat environments.

These same features allow the results of an initial J100 risk and resilience assessment to be updated easily, by focusing only on areas where there have been changes, such as:

- The nature or likelihood of the threats,
- The vulnerability of the assets, and
- The consequences of the threat scenarios

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1.12 SAFETY Act Protection

Notes:

The Support Anti-terrorism by Fostering Effective Technologies Act is referred to as the SAFETY Act. It was passed by Congress in 2002 to address the large liabilities that entities might face if a terrorist attack occurs despite deployment of anti-terrorism security measures. Congress designated the SAFETY Act as an incentive for the creation and deployment of technologies and services with anti-terrorism capabilities. Under the SAFETY Act designation, both the entity that creates the anti-terrorism security measure and the entity that deploys the anti-terrorism measure are eligible for certain liability protections. AWWA received SAFETY Act designation for J100 in 2012.

This designation carries important liability protection for utilities (and consultants who assist them) that properly implement J100. Following J100 will not only result in a more resilient utility, but will also provide SAFETY Act liability protection, in the event of a terrorist act. Therefore, close adherence to the standard is important.

(Pictures source: Morley, AWWA, "Illinois Section Security Training", May 2011, ppt slide 11)

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1.13 Module 1:

Notes:

Now, with that background behind us, let's jump into Module 1, which is an overview of the J100 standard.

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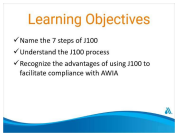
1.14 Learning Objectives



Notes:

These are the learning objectives for this module. After successfully completing the module, participants will be able to name the 7 steps of J100, understand the J100 risk assessment process, and recognize the advantages of using the J100 standard to facilitate compliance with the AWIA.

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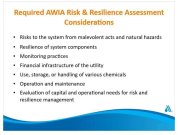
1.15 Required AWIA Risk & Resilience Assessment Considerations



Notes:

Before we get too deep into J100, let's review the risk and resilience assessment considerations required by the AWIA. The Act requires that these assessments, at a minimum, consider the following:

- Risks to the system from malevolent acts and natural hazards
- Resilience of system components
- Monitoring practices - which refers to monitoring systems for such things as operations, water quality, energy, and security
- Financial infrastructure of the utility - which refers to cybersecurity for business and accounting systems, such as customer billing
- The use, storage, or handling of various chemicals
- Operation and maintenance, and
- The evaluation of capital and operational needs for risk and resilience management
- The last bullet really sums up what the utility needs to know, and fortunately, the output from a J100 assessment provides precisely this

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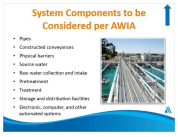
1.16 System Components to be Considered per AWIA



Notes:

So, the previous slide indicated that utilities are required to assess the resilience of system components. This slide presents the specific types of components that the Act refers to:

- Pipes
- Constructed conveyances
- Physical barriers
- Source water
- Raw water collection and intake
- Pretreatment
- Treatment
- Storage and distribution facilities, and
- Electronic, computer, and other automated systems

Please take a moment to click on the link at the upper right corner of this slide and download the handout that summarizes the risk and resilience assessment requirements of the AWIA. This handout will help when you are taking the quizzes later in this module.

Photo: Travis AFB, Water Treatment Plant (publicdomain - military source)
https://www.afcec.af.mil/News/Photos/igphoto/2001278193/

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1.17 J100 Methodology

Notes:

Now let's dive into the J100 methodology and in a few minutes you will begin to see how J100 can help facilitate compliance with the requirements of the AWIA. J100 has 7 steps.

- First you identify critical assets
- Then select appropriate threats and hazards to apply to each asset
- This generates what we call threat-asset pairs
- Then you calculate the consequence, vulnerability, and threat likelihood of each threat-asset pair
- Then we use the risk equation discussed earlier, and multiply together C, V, and T to yield baseline risk.
- Later in this course we'll also discuss later how to calculate baseline resilience using a similar equation.
- In the last step, you consider various mitigation measures that could mitigate risks and improve resilience, and then re-calculate
- This final risk and resilience management step helps you understand the degree to which the selected mitigation measures can reduce risk and improve resilience.

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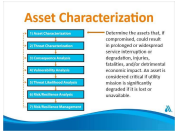
1.18 Asset Characterization



Notes:

Let's look at each of the 7 steps in more detail. During the asset characterization step, you determine the assets that, if compromised, could result in prolonged or widespread service interruption or degradation, injuries, fatalities, and detrimental economic impacts. An asset is considered critical if its absence or unavailability would significantly degrade the ability of a utility to carry out its mission or would have unacceptable financial, political, or physical consequences for the utility, the community, or the environment.

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1.19 Threat Characterization

Notes:

During the threat characterization step, we consider applicable malevolent threats, natural hazards, and dependency / proximity hazards. We apply threats and hazards to each critical asset to create threat-asset pairs.

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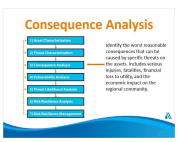
1.20 Consequence Analysis



Notes:

During the consequence analysis step, we quantify the worst reasonable consequences that could result from each threat-asset pair.

Consequence is comprised of the following 4 components:

1. Number of fatalities
2. Number of serious injuries
3. Financial loss to the owner
4. Economic loss to the community or region

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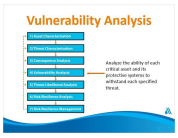
1.21 Vulnerability Analysis



Notes:

During the vulnerability analysis step, we analyze the ability of each critical asset and its protective system to withstand each specified threat. Vulnerability is defined as the likelihood that when a threat occurs, that the threat is successful in causing the worst-case consequence to occur.

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1.22 Threat Likelihood Analysis

Notes:

During the threat likelihood analysis step, we estimate the likelihood of malevolent events and dependency hazards to occur, and estimate the probability of natural hazards.

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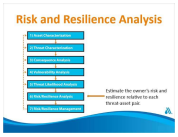
1.23 Risk and Resilience Analysis



Notes:

During the risk and resilience analysis step, we estimate the owner's risk and resilience relative to each threat-asset pair. This is baseline risk and baseline level of resilience.

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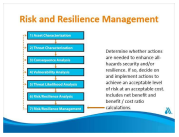
1.24 Risk and Resilience Management



Notes:

Finally, during the risk and resilience management step, we determine whether actions are needed to enhance all-hazards security and/or resilience. If so, we evaluate actions to achieve an acceptable level of risk at an acceptable cost. This step includes calculations of net benefit and benefit / cost ratio.

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1.25 J100 Methodology

Notes:

The graphic on the right is an alternative way of representing the 7 steps of J100. This version of the flow chart groups the 7 steps into 4 basic activities. When we are actually implementing J100, steps 1&2 are conducted concurrently, then steps 3,4,&5 are conducted in conjunction with each other. As we mentioned earlier, the analysis of Consequence, Vulnerability and Threat likelihood yields baseline risk and resilience; and the final step is where we evaluate risk reduction measures and measures that can improve resilience.

Now, please click on the link at the upper right corner of the slide to download a handout that summarizes the J100 process. You will find this useful when taking the quizzes contained in this course.

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***1.26 Activity* (Sequence Drag-and-Drop, 10 points, 3 attempts permitted)**

Correct Order
Asset Characterization
Threat Characterization
Consequence Analysis
Vulnerability Analysis
Threat Likelihood Analysis
Risk/Resilience Analysis
Risk/Resilience Management

Feedback when correct: That's right! You selected the correct response.

Feedback when incorrect: You did not select the correct response. Please review the previous slide for help.

Notes: Okay, this is an activity to test your understanding of the J100 steps. Drag and drop the 7 steps of J100 on the right into the boxes on the left to create the proper sequence of steps.

Correct order:
Asset Characterization
Threat Characterization
Consequence Analysis
Vulnerability Analysis
Threat Likelihood Analysis
Risk/Resilience Analysis
Risk/Resilience Management

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1.27 Knowledge Check 1

(True/False, 10 points, 2 attempts permitted)

Correct	Choice
X	True
	False

Feedback when correct:

That's right! You selected the correct response. Choosing which assets are critical to the mission and which threats could occur at the utility is the correct start to a risk and resilience assessment.

Feedback when incorrect:

You did not select the correct response. Please reference slide 25.

Notes:

Let's further test your understanding of the J100 process. Indicate which of the statements about J100 is true or false.

Correct answers:
a) True- Choosing which assets are critical to the mission and which threats could occur at the utility is the correct start to a risk and resilience assessment

b) False- Vulnerability is the likelihood that when a threat occurs, that threat is successful in causing the worst-case consequence to occur.

c) True- These are the components of the Risk equation R= C*V*T

d) False- Risk is about the negative effect that could occur, whereas resilience is about maintaining the utility's mission despite the actual risk

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1.28 Knowledge Check 2

(True/False, 10 points, 2 attempts permitted)

Correct	Choice
	True
X	False

Feedback when correct:

That's right! You selected the correct response. Vulnerability is the likelihood that when a threat occurs, that threat is successful in causing the worst-case consequence to occur.

Feedback when incorrect:

You did not select the correct response. Please reference slide 25.

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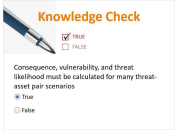
1.29 Knowledge Check 3

(True/False, 10 points, 2 attempts permitted)



Correct	Choice
X	True
	False

Feedback when correct:

That's right! These are the components of the Risk equation R= C*V*T.

Feedback when incorrect:

You did not select the correct response. Please reference slide 25.

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1.30 Knowledge Check 4

(True/False, 10 points, 2 attempts permitted)

Correct	Choice
	True
X	False

Feedback when correct:

That's right! Risk is about the negative effect that could occur, whereas resilience is about maintaining the utility's mission despite the actual risk.

Feedback when incorrect:

You did not select the correct response. Please reference slide 25.

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1.31 Benefits of J100 Methodology

Benefits of J100 Methodology

- Prioritize risks
- Quantify potential consequences
- Support long-term planning
- Justify investments
- Ensure return on investment
- Build a foundation for continuous improvement
- Protect the public and decision makers

Notes:

Let's discuss some of the benefits of J100. We've already mentioned that J100 is one of AWWA's voluntary consensus, standards; that it takes an all-hazards approach; and that it receives the liability protections of the SAFETY Act. In addition to these benefits, J100 provides utilities with a tool to prioritize risks and quantify potential consequences. The results of a J100 assessment can be used to support long-term planning and justify necessary investments. J100 results can also be used to build a foundation for continuous improvement. Because threats and hazards continue to evolve, risk and resilience management is not a one-time thing - it is not a destination, it is a journey. Finally, a J100 assessment and subsequent risk mitigation and resilience enhancements can protect not only the utility, but also the public, and decision makers. It protects the public from water supply disruptions and it protects decision makers by demonstrating due diligence in the evaluation of risk at the utility.

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1.32 RAMCAP Plus

The J100 Process is Selective

Notes:

J100 is a comprehensive methodology, but it uses selective decision criteria be efficient and to concentrate analysis and assessment resources on the most important risks.

The process calls for prioritizing and "bottom-cutting" at several points:

- The first opportunities for bottom cutting are in the Asset Characterization step
  - First, all facilities that are not critical to the functioning of the system are eliminated from the analysis or deferred until some later time.
  - Next are the non-critical assets in critical facilities.
  - Finally are the critical assets in critical facilities that have very low consequences or low threat likelihood.
- The next opportunity for prioritization and bottom cutting occurs during a preliminary screening process after Step 2
- During this preliminary screening, threat-asset pairs that have very low consequences or threat likelihood can be eliminated from the analysis or deferred
- In Step 6, threat-asset pairs can be eliminated if they are judged to have a level of risk and resilience that is acceptable to the utility.
- In Step 7, threat-asset pair mitigation options are eliminated if they have very low net benefits
- This selective prioritization process improves the efficiency of the risk and resilience assessment process and helps the utility focus their limited resources on high-impact mitigation strategies.

Later in this course, we will spend more time discussing the details of these prioritization opportunities.

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1.33 Core Team for RRA

Core Team for RRA

- Team Leader
- Risk Analyst
- Security
- Safety
- Treatment / Distribution Operations and Maintenance
- Engineering
- Information Technology

Notes:

Conducting a J100 RRA should not be the responsibility of a single person. It should be a collaboration among a number of key stakeholders within the utility. The core team should include:

- A Team Leader and Champion from the utility
- A Risk Analyst that can be an appropriately trained utility employee or an outside consultant
- Plus utility representatives from
  - Security
  - Safety
  - Treatment and Distribution Operations and Maintenance
  - Engineering and
  - Information Technology

In order to achieve the most accurate and beneficial outcome from the RRA, these stakeholders should be highly engaged at numerous points within the assessment process. It is a benefit to the utility for these key stakeholders to invest time in the RRA because the process of conducting the RRA helps elevate their awareness of the most important issues facing the utility.

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1.34 Additional RRA Stakeholders

Additional RRA Stakeholders

- Legal
- Human Resources
- Customer Service
- Finance
- Laboratory / Compliance
- First Responders

Notes:

In addition to the core assessment team, there are other utility representatives that have special knowledge that will be needed periodically, during the assessment. These include representatives from:

- Legal
- Human Resources
- Customer Service
- Finance
- Laboratory services
- Regulatory Compliance, and
- First Responders

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1.35 Stakeholder Engagement

Stakeholder Engagement

- Discuss and achieve consensus on
  - Critical assets
  - Relevant threats and hazards
  - Risk / resilience management recommendations
- Strike a balance between
  - Mitigation resources needed
  - Willingness to accept risk
  - Take ownership of results

Notes:

Stakeholder engagement is a key part of the J100 process. It is common to have two or more stakeholder workshops to engage stakeholders in the assessment process and to discuss and achieve consensus on such things as:

- Critical assets
- Relevant threats and hazards
- Risk / resilience management recommendations

Workshops can also help the stakeholders understand what they should expect from a J100 assessment and take ownership of the results. No utility will have enough resources to address every risk that is identified. It will be necessary to strike a balance between the mitigation resources the utility can afford to apply toward risk reduction vs the willingness of the utility to accept some degree of risk. Workshops are very important for reaching consensus on risk management priorities and helping the stakeholders take ownership of these difficult decisions.

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1.36 Using J100 to Comply with AWIA

Using J100 to Comply with AWIA

- Risks to the system from malevolent acts and natural hazards
- Resilience of system components
- Monitoring practices
- Financial infrastructure of the utility
- Use, storage, or handling of various chemicals
- Operation and maintenance
- Evaluation of capital and operational needs for risk and resilience management for the system

Notes:

Let's discuss how J100 can be used to "facilitate compliance with" AWIA requirements. This slide provides a reminder of what the Act requires with respect to RRAs and in the next few slides we will map out how J100 can be used to facilitate compliance with the Act.

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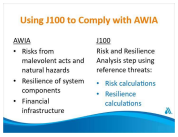
1.37 Using J100 to Comply with AWIA



Notes:

Now let's consider how J100 can be used to achieve the requirements of the Act. On the left are several requirements of the Act and on the right are the ways in which J100 can help achieve these requirements. Obviously, the risk and resilience calculations in J100 help evaluate the risk and resilience requirements of the Act. The concept of financial infrastructure in AWIA essentially refers to security and resilience of business networks - and cyber attacks against these networks are one of the threats evaluated in J100, along with resilience of data and servers.

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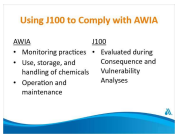
1.38 Using J100 to Comply with AWIA



Notes:

Monitoring practices; use, storage, and handling of chemicals; and operation and maintenance are all evaluated during Consequence and Vulnerability Analyses. Both of these, when performed well, can reduce consequences and vulnerability associated with various threat-asset pairs.

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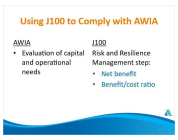
1.39 Using J100 to Comply with AWIA



Notes:

One of the most important requirements of the Act is to evaluate capital and operational needs for risk and resilience management. Two of the outputs from the J100 risk and resilience management step are net benefit and benefit cost ratio. Developing these metrics involves calculating the cost of mitigation measures and assessing the return on investment of implementing various measures. This information would then help the utility evaluate capital and operational needs.

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***1.40 Match the J100 steps listed on the right to the appropriate boxes on the left, which are the AWIA requirements that the J100 steps support.* (Matching Drag-and-Drop, 10 points, 3 attempts permitted)**

Correct	Choice
Risks from malevolent acts	Risk and Resilience Analysis
Evaluation of capital needs	Risk and Resilience Management
Use, storage, and handling of chemicals	Consequence and Vulnerability Analyses

Feedback when correct:

That's right! You selected the correct response.

Feedback when incorrect:

You did not select the correct response. Please refer back to slides 31-33.

Notes:

Now let's test your understanding of the ways that J100 can help facilitate compliance with AWIA. This is an exercise to match the output from a J100 assessment to the compliance requirements in the AWIA. Drag and drop the J100 features listed on the right into the appropriate boxes on the left.

AWWA: If they get the answer wrong, refer back to slides 31-33

Correct answers:

Risk and Resilience Mgmt -> Evaluation of capital needs

Risk and Resilience Analysis -> Risks from malevolent acts

Consequence and Vulnerability Analyses -> Use, storage, and handling of chemicals

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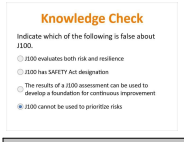
1.41 Knowledge Check 5

(Multiple Choice, 10 points, 3 attempts permitted)



Correct	Choice
	J100 evaluates both risk and resilience
	J100 has SAFETY Act designation
	The results of a J100 assessment can be used to develop a foundation for continuous improvement
X	J100 cannot be used to prioritize risks

Feedback when correct:

That's right! You selected the correct response. J100 can be used to prioritize risks

Feedback when incorrect:

You did not select the correct response. J100 does evaluate both risk and resilience, it has SAFETY Act designation and the results of a J100 assessment can be used to develop a foundation for continuous improvement.

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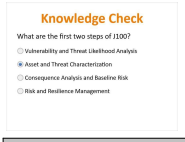
1.42 Knowledge Check 6

(Multiple Choice, 10 points, 3 attempts permitted)



Correct	Choice
	Vulnerability and Threat Likelihood Analysis
X	Asset and Threat Characterization
	Consequence Analysis and Baseline Risk
	Risk and Resilience Management

Feedback when correct:

That's right! You selected the correct response. Asset and Threat Characterization are the first two steps

Feedback when incorrect:

You did not select the correct response. For your reference, Vulnerability and Threat Likelihood Analysis are the 4th and 5th steps, Consequence Analysis and Baseline Risk are the 3rd and 6th steps and Risk and Resilience Management is the 7th step.

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1.43 Knowledge Check 7

(Multiple Choice, 10 points, 3 attempts permitted)

Knowledge Check

Which of the following is the correct J100 risk equation?

- (•) R = C*V*T
- ( ) V = R*C*T
- ( ) C = V*R*T
- ( ) T = C*T*R

Correct	Choice
X	R = C*V*T
	V = R*C*T
	C = V*R*T
	T = C*T*R

Feedback when correct:

That's right! You selected the correct response. Risk for each Threat-Asset pair is calculated by multiplying the Consequence times the Vulnerability times the Threat Likelihood.

Feedback when incorrect:

You did not select the correct response. This reorganizes the terms in an incorrect manner

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1.44 Closing

This concludes Module 1. In this module we learned:

- The 7 steps of J100
- The J100 process, and
- The advantages of using J100 to facilitate compliance with AWIA

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Notes:

This concludes Module 1. In this module we learned:

The 7 steps of J100

The J100 process, and

The advantages of using J100 to facilitate compliance with AWIA

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