

SOFT TARGETS: Assessing Risk & Cost

PART TWO

Prepared For:

NCITE NATIONAL COUNTERTERRORISM,
INNOVATION, TECHNOLOGY,
AND EDUCATION CENTER
A U.S. DEPARTMENT OF HOMELAND SECURITY CENTER OF EXCELLENCE



Prepared by: University of Nebraska Omaha MBA Capstone Team

Joe Mannschreck

Weiham Weng

Kanishka Hamidi

Paige Kristensen

Overseen by: Dr. Erin Pleggenkuhle- Miles, Associate Professor of Management

Table of Contents

Meet the Consultants.....	3
Executive Summary	4
Background.....	4
Project Description.....	5
Scope of Work	5
Methodology Overview	5
Risk Assessment	6
Identification of Assets	6
Identification of Threats.....	6
Risk Dimensions & Sub-Dimensions	7
Likelihood	7
Vulnerability	8
Consequences.....	10
Risk Score Calculation.....	13
Analysis and Findings.....	13
Top Five Risks	14
Assumptions and Limitations of Findings	14
Next Steps	15
References.....	16
Appendix.....	20
Risk Scoring.....	21
Infographic.....	26
Glossary	27

Meet the Consultants

The interdisciplinary team tasked with the multi-lens analysis of Baxter Arena was led by Dr. Austin Doctor, Assistant Professor and Head of Counterterrorism Research Initiatives and Michael Smith, General Manager of Baxter Arena. The current MBA consulting team focusing on economic and risk analysis included Joe Mannschreck, Kanishka Hamidi, Weihan Weng, and Paige Kristensen.



Joe received his undergraduate degree from the University of Nebraska at Kearney with a degree in Business Administration, emphases in Finance and Marketing. He currently works as a Director of Trading at Orion Portfolio Solutions in Omaha, NE. He was motivated to work on this project because he is an avid attendee of Baxter events, primarily concerts, and wants to do what he can to keep Baxter safe so he can continue attending fun events.



Kanishka has an accounting degree and currently works as a Senior financial analyst at Lindsay Corporation. He has over 8 years of financial analysis experience. He chose to work on this project because he is a big sports fan and believes everyone playing sports and watching sports should feel safe and enjoy the experience. “Baxter arena is a symbol of sports in Omaha, and I want to contribute towards its safety and security in any capacity I can.”



Weihan received his first bachelor's degree in finance from Guangzhou College of Commerce in China, and he came to U.S for his second bachelor's degree in business administration at University of Nebraska at Omaha. Now, he works as a venture analysis at UNeTech Institute and has accumulated a lot of experience in strategic management. The reason he wanted to be involved in this project is that he was passionate about quantifying risk and wanted to contribute to the Nebraska community.



Paige has a degree in Business Administration and Sports Management from the University of Nebraska at Kearney with experience in event planning at facilities such as the Health and Sports Center in Kearney, Nebraska, and the T-Mobile Center, Hy-Vee Arena, and Municipal Auditorium in Kansas City, Missouri. She wanted to work on this project because she wants current and upcoming sports venues to keep safety at the forefront for not only athletes, but the spectators and surrounding community of these facilities.

Executive Summary

Public arenas, sports venues, and stadiums all have more in common than just hosting major community events, sports matches, and concerts. While those are their main purpose, they are all also susceptible to being a target of a terrorist attack due to their accessibility to the public, bottle neck areas, and limited security measures (DHS). While Baxter arena is not considered unsafe, there is always room for increased safety measures to protect against a potential attack.

This project is a continuation of the UNO's (University of Nebraska at Omaha) Spring 2023 MBA Capstone class analysis and the interdisciplinary teams comprising business, computer science, and engineering students. The previous teams have identified best practices for venue security, simulations to visualize the impacts of an attack, and potential improvements to the facility. Because of the impactful research, action has already been taken at Bater Arena based on their suggestions. This report focuses on the risk assessment of assets the arena has and the potential economic impact a terrorist attack would cause the arena and UNO.

This report will outline the top five most impactful potential attacks on Baxter arena in terms of likelihood, vulnerabilities, and consequences to prioritize safety improvements for Baxter leadership to consider. Our team has also determined a risk scoring method that can be applied to Baxter Arena and other venues on and off UNO's campus. As a result of risk scoring, NCITE and Baxter Arena should continue to pursue the three, six, and twelve month plans of Team One, continually monitor and update the "sub-dimension" scores that are included in the report, adjust the weighting of assets based on the venue being evaluated, and apply this method to current and future venues at UNO.

Background

Team One of the Baxter Arena Capstone groups identified four main vulnerabilities of the facility and are captured in Table 1.

Vulnerabilities of Baxter Arena	
Internal	External
Vendors and staff propping open critical doors	Proximity to 67 th street
Walls made of glass	Entrances not protected from vehicle ramming

Table 1. Identified Vulnerabilities

According to Team One, propping open doors for ease of moving and access leaves critical infrastructure like ammonia supply, propane storage, electrical access, and equipment storage vulnerable. Through a tour of the facility, they also observed that the facility itself is enclosed in walls of transparent glass. While this provides a modern look, it is not the most secure for external walls. They also identified external weaknesses like Baxter's proximity and access to 67th street; a main street in the Aksarben area, and the lack of protection of the facility from the street and parking lot areas. Team One made recommendations to request an updated infrastructure survey security and resilience report, seek further analysis of options for consideration, and conduct a risk and cost analysis. Team Two has followed up with these

recommendations and Baxter Arena is already implementing some changes to safety and access. Now that Team One has identified threats, Team Two aims to determine financial impact and a numerical score of a potential physical attack on Baxter arena using a risk analysis scoring method that our team has developed.

Project Description

Baxter Arena is Omaha's premier mid-sized events venue. With a capacity of over 7,800, Baxter holds Division I hockey, basketball, volleyball, concerts, and various UNO and community events. Because it is a prominent building that hosts a broad range of events, Baxter Arena falls within the definition of the Department of Homeland Security's defined term of "soft-targets and crowded places" (ST-CP) (CISA.gov US Dept of Homeland Security Soft Targets and Crowded Places Security Plan Overview). With construction costs just over \$80 million, the Baxter facility is worth protecting. However, we argue that there is a lot more at stake. Not only would there be chaos immediately following a potential attack, but ripples of negative effects impacting countless stakeholders. Our goal in this project was to give these vulnerabilities a value that can be measured, evaluated, and compared to other venues.

Scope of Work

Since this team is one part of the UNO Interdisciplinary group evaluating Baxter as a soft target, we aim to provide insight to this complex puzzle. Specifically, how might we assess the economic impact of an attack on a soft target, such as Baxter Arena, and provide legitimacy to factors that should be considered when building in the future for the Nebraska University system. Through meeting with Baxter personnel and NCITE leadership, we identified a relative risk score for multiple attack scenarios based on vulnerabilities and critical infrastructure of Baxter Arena in terms of a physical terrorist attacks. Since overall risk is a product of threats, vulnerabilities, and consequences, our next step was to identify these dimensions for Baxter Arena (CCICDA).

Methodology Overview

Several sources discuss best practices for assessing risk, many of which are influenced or published directly by The Department of Homeland Security. We found two sources in particular that applied directly to Baxter Arena. The first is an article from *The Sport Journal* entitled "Introducing a Risk Assessment Model for Sport Venues." The article outlines a step-by-step process that includes major considerations and suggests a numerical score should be assigned for overall risk. The other source is an article from the DHS entitled "Software Suite Will Harden Defenses for Soft Targets". This article introduced a technique that joins assets of a venue with various types of terrorist attacks to get an assessment of the impact on the assets for a given attack.

With these articles and techniques in mind, we developed a 6-step process for risk assessment, denoted in **Table 2**:

DHS Assessment of Risks
Step 1. Identification of Assets – critical pieces of infrastructure for the venue
Step 2. Identification of Threats – the types of terrorist attacks that may occur
Step 3. Assessment of Likelihood – the chances a threat will occur
Step 4. Assessment of Vulnerabilities – factors that could lead to success for the attacker, such as the accessibility of assets.
Step 5. Assessment of Consequences – the negative results following an attack, including economic impact
Step 6. Calculate Risk Score – derived from the outcomes of each assessment

Table 2. DHS Assessment of Risks

Our team utilized these criteria to form the basis of our analysis of Baxter Arena.

Risk Assessment

In this section, we walk through how we developed our risk assessment model to evaluate implications of a potential terrorist event specific to Baxter Arena.

Identification of Assets

General Manager of Baxter, Michael Smith, provided insight into the critical infrastructure of the building. Critical infrastructure was captured as “without it, the venue could not operate or host events.” We determined critical infrastructure as “assets” in our analysis. These assets include the **backup generator**, located outside the building on the northeast side, the **ammonia supply and system**, located inside the building in a restricted area only accessible via keycard, the **propane supply**, located outside the facility with no barrier or lock, and the **utilities**, also located inside the building in a restricted area only accessible via keycard. The utilities are critical because everything, including cameras, keypad locks, phones, run on electricity and the internet. The list of assets was determined through discussions with the client and a tour of the facility and are summarized in **Table 3**.

Assets to Baxter Arena
<ul style="list-style-type: none"> ▪ Backup generator ▪ Ammonia supply and system (ice rink refrigerant) ▪ Propane storage (fuel source for machinery) ▪ Utilities (main electric, gas, water)

Table 3. Baxter Arena Assets

Identification of Threats

Once assets were determined, “threats” were identified next. Threats were defined as the types of terrorist attacks that may occur. The list was selected based on the Statista distribution of attack types used in acts of terrorism (Figure 1), as well as from the findings from MBA Team 1.

According to this distribution, shootings and bombs account for 76% of attack types. Additionally, drone attacks were mentioned by the client as a concern, and the previous MBA team identified Vehicle Ramming as a potential threat, so these were included. In total, six threats were evaluated in the assessment as shown with definitions in **Table 4**.

Potential Threats to Baxter Arena Operations	
▪	Firearms-assault – Active shooter, close proximity to victims, on foot
▪	Bomb-assault – Similar to active shooter but weapon of choice is explosives, military grade, not homemade
▪	Bomb-IED – <i>Improvised Explosive Devices</i> - inclusive of incendiaries, suicide bombing, planted bombs
▪	Bomb-IED via drone – IED's delivered via drone
▪	Bomb-IED via vehicle ramming – IED's delivered via vehicle by driving into crowd or building, car bombs
▪	Vehicle ramming – Using a vehicle to ram into victims, no presence of a bomb

Table 4. Potential Threats to Baxter Arena's Operations

Now that plausible treats on assets have been identified, we paired each asset with each threat (e.g., Backup Generator + Vehicle Ramming). This was a technique identified in the article “Software Suite Will Harden Defenses for Soft Targets” from the DHS. This technique allowed us to evaluate the impact on the infrastructure of Baxter given the type of attack that might occur.

Risk Dimensions & Sub-Dimensions

After assets and threats were identified, there were 3 primary dimensions and 16 sub-dimensions used to evaluate risk. These dimensions were derived from multiple sources, as well as from our consulting team based on what we determined relevant to our assessment. **Table 5** illustrates each of the primary and sub-dimensions included in the assessment.

Likelihood	Vulnerability	Consequences
Frequency	Visibility	Reputation
Comparative Attacks	Criticality	Response
Location	Capacity	Replacement
Ideology	Casualties	Fines
	Adjacent Impact	Productivity
	CBRNE Elements	
	Accessibility	

Table 5. Dimensions & Sub-Dimensions

Likelihood

Terrorist attacks on sports venues has historically been uncommon in the United States (Rahman et al). However, they are still considered attractive targets for mass casualties. To determine the

plausibility of an attack on Baxter Arena, “Likelihood” was calculated by considering four sub-dimensions: **Frequency, Comparative Attacks, Location, and Ideology**. These dimensions were determined by the consulting team, and from a discussion with NCITE Director, Dr. Gina Ligon. In efforts to give adequate weight to the vulnerabilities of the venue and the consequences of an attack, the likelihood dimension was given a weight of 20% when calculating the averages.

Frequency

Frequency of the combined asset and threat pair was estimated by current trends in terrorist patterns, firearm laws in the state of Nebraska, and the most common attacks in general. The mode in which the attack is carried out is also a consideration of the analysis. According to the START research data, the use of incendiary devices is on an upward trend. Incendiary devices are designed to start fires. Based on those findings, threats including bombs/ improvised explosive devices (IEDs) were rated as “high” and “severe.”

Comparative attacks

Comparative attacks are a sub-dimension that considers the plausibility of an attack on a university or similar venue to Baxter Arena. There were over 2,600 terrorist attacks in the United States over a 43-year span with 3,500 fatalities (START). Common targets of these attacks were densely populated areas and 78% of attacks against educational targets were on schools and universities (START). Given this information, comparative attacks were rated as “medium” and “high” depending on the asset and threat identified.

Location

Location as a sub-dimension was determined by the climate in the Aksarben area, the city of Omaha, and state of Nebraska. Location also factored in the ease of access for a large number of people. Since Baxter can hold over 7,000 people and is part of a public campus, scores in this sub-dimension ranged from “low” to “high” depending on the physical location of the asset being evaluated.

Ideology

For the purpose of this project, we are assuming that the context of the event targeted is not ideologically charged. Thus, we scored this dimension as a 1. If using this scoring method to evaluate other facilities or events that are ideologically polarizing, score this sub-dimension as a 4. For example, political rallies, campaign fundraisers, guest speakers with polarizing topics, or concerts with artists who have well-known platforms should be ranked as a 4 instead of 1.

Vulnerability

This dimension determines the characteristics of the venue that may lead to success for an attacker. The sub-dimensions were primarily derived from *The Sport Journal* article “Introducing a Risk Assessment Model for Sport Venues”. The consulting team made minor changes to definitions based on relevance and to keep the assessment limited to the university/Baxter vs the surrounding community. From this, we broke Vulnerability down into 7 sub-dimensions: **Visibility, Criticality/Dependency, Capacity, Casualties, Adjacent Impact, CBRNE Elements, and Accessibility**. (Hall et al.)

Visibility

Visibility was defined as the “awareness of existence and visibility” of an asset to the staff, vendors, and visitors of Baxter Arena.

Criticality/Dependency

Criticality/Dependency was determined by how critical an asset is to Baxter’s operations. When analyzing this sub-dimension we asked ourselves “If the asset were to be damaged, how severe would the impact be on Baxter’s ability to continue operating?”

Capacity

Capacity was a measurement of the population of Baxter. For this sub-dimension, we tied the population into the asset and type of attack. This was meant to gauge the capacity of the venue at risk given where the asset was located, and the type of attack that might occur. With this in mind, we set the total capacity of Baxter at 8,000 people, this includes visitors and staff (Smith and Doctor). We took the total capacity divided by 4 to get our ranges for Low (1-1,999), Medium (2,000-3,999), High (4,000-5,999), and Severe (6,000+).

Casualties

Casualties is a measurement of the potential for “mass casualties”. For analyzing a delicate dimension like casualties, we used the definition for Mass Casualty Incident (MCI) from the National Library of Medicine - “an event that overwhelms the local healthcare system, where the number of casualties vastly exceeds the local resources and capabilities in a short period of time” (DeNolf and Kahwaji). This definition means the number of casualties is subjective and will vary based on venue when determining if an event is an MCI or not.

To determine the number of casualties, we considered an MCI for the project. We reviewed the number of licensed hospital beds in the two main hospitals nearest Baxter: *Alegent Health Bergan Mercy Health System dba CHI* (**396 licensed beds**) and *The Nebraska Methodist Hospital DBA Methodist Hos* (**447 licensed beds**) (Department of Health and Human Services). This gave us 843 beds. Based on this, we set our ranges for number of mass casualties at Low (1-199), Medium (200-399), High (400-599), and Severe (600+).

Adjacent Impact

Adjacent Impact was a look at the potential for impact outside of the venue. This came down to the location of the assets on the grounds. Assets located outside of the main walls of the venue received a higher score for adjacent impact.

CBRNE Elements

CBRNE is short for Chemical, Biological, Radiological, Nuclear, and Explosive. Attacks were gauged based on the presence of these elements in the attack. Baxter has infrastructure dependent on ammonia, natural gas, and propane, all flammable and explosive gases. Where those elements were present in an attack, they received a higher score for CBRNE Elements.

Accessibility

Accessibility was determined by the availability of the asset for a potential threat, I.e. How easy would it be for an attacker to access the asset? Furthermore, how would this availability

contribute to success for the attacker? For this we considered the weaknesses identified by the previous MBA team:

- 67th Street access
- Propped open doors to restricted areas
- Glass walls/windows
- No vehicle barriers

Consequences

The consequences dimension refers to the negative outcomes following an attack. Multiple sources from the DHS talk about this dimension when measuring overall risk of an attack. For the purposes of our assessment, we limited this dimension to strictly measure the economic impact of a terrorist attack. To do this, we leveraged a monetary impact assessment from the *FAIR Institute*, which resulted in the formation of 5 sub-dimensions: **Reputation, Response, Replacement, Fines & Judgements, and Productivity**.

Reputation

Reputation refers to the image of the organization in the minds of the public and stakeholders. Threats such as the shooting would affect the prestige of Baxter Arena and UNO, which could reduce student enrollment, especially international students (Suarez).

This sub-dimension was primarily measured by determining the potential decrease in enrollment and translating that to tuition dollars. We found the potential for a 5.5% decrease in enrollment following shooting attacks (Ordway et al.). We used this as a baseline, and then used the number of students enrolled in 2022 of 15,058 (University of Nebraska System Fall Enrollment), as well as the price of in-state and out-of-state tuition per year of \$8,136 and \$21,718, respectively ("University of Nebraska Omaha Tuition & Financial Aid").

From there, we calculated a worst-case scenario by assuming the entire 5.5% decrease in enrollment would come from out-of-state students. This also highlighted the potential for decreased international student enrollment. This comes out to $15,058 \times \$21,718 = \$327,029,644$ * 5.5% = \$17,986,630. This was then divided by 4 to get our ranges for Low, Medium, High, and Severe.

Response

Response refers to the costs and actions of an organization immediately following an attack. We viewed this dimension as a "first response", and determined what sort of measures would be taken immediately that would contribute to the cost impact of a threat. For this, we primarily measured the dimensions by reviewing medical costs and insurance claims.

According to the University of Nebraska System Annual Comprehensive Financial Report, the 2022 health insurance claims was \$16,760,000 (University of Nebraska System). We took this value divided by 4 to determine Low, Medium, High, and Severe ranges for medical costs that might be incurred.

As an alternative to this calculation, we also found the average cost per person of an in-patient hospital stay from shooting attack was \$31,000 (Beyer). This could be used in conjunction with the potential number victims of a threat to determine the overall cost of medical bills. We made the decision to build our ranges based on a university financial report vs a per person basis because the number of victims is difficult to determine, and this would allow us to equate our numbers to an existing cost of the university.

Replacement

Replacement refers to the cost of repairing or replacing infrastructure following an attack. Potential threats can result in damage or destruction to stadium buildings, grounds, and equipment requiring repair or replacement, resulting in costly restoration. An additional consideration is the cost of mitigating such an attack in the future, such as including vehicle barriers in rebuild construction costs.

For the assessment, we calculated Replacement costs by determining the cost of each Asset. We found the cost of a commercial backup generator to be around \$8k-\$20k (“How Much Do Commercial Generators Cost? | PriceItHere.com”) The price of a new ammonia system was \$2.66 million (Fischenich). The cost of propane was around \$1.85 per gallon (Nebraska Department of Environment and Energy), and estimated Baxter has around 10 23.6-gallon tanks on hand, equaling around \$440 ($\$1.85 \times 23.6 \text{ gal per tank} = \$43.66 \times 10 \text{ tanks} = \sim \440).

Lastly, the cost of installing utilities systems was calculated as a percent of the overall construction budget. We found the original construction cost of Baxter Arena was \$82 million (“Frequently Asked Questions | Athletics | University of Nebraska Omaha”) and the cost of utilities systems is around 4.4% - HVAC, 4.3% - Plumbing, and 4.2% - Electrical (“Commercial Construction Costs per Square Foot [2023] | ProEst”). For a worst-case scenario cost, we added up each percentage and multiplied by the original cost of construction to get around \$10.5 million, this was our Severe range. Ultimately, we measured Low = no replacement costs, Medium = cost of backup generator and/or propane, High = cost of ammonia system, and Severe = cost of replacing utilities systems.

Fines and Judgments

Fines and Judgments refers to actions imposed on organizations through civil, criminal or contractual actions (Suarez). This includes the potential increase in insurance premiums, as well as potential litigation from victims following an attack. These were the 2 major factors included in the assessment of costs of fines and judgments.

For insurance costs, we found that some insurance companies may not even ensure ammonia systems for ice rinks because these locations are generally open to the public, presenting a public health risk (Burley). Because of this, threats where the ammonia supply was involved were scored higher than others.

Regarding litigation costs, there is evidence that venues can be held responsible for attacks if they were negligent or had inadequate security. We used the shooting attack at Virginia Tech as a case study for potential costs. Additionally, the Vegas shooting was taken into consideration,

although the differences of that event and venue made it less of a factor in considering potential cost.

In those cases, Virginia Tech originally settled a wrongful death suit to pay \$4 million per victim, however, this was later reduced to \$100k per victim (Mears). There were 32 victims in that case, which totals \$3.2 million. In the Vegas shooting, MGM paid \$49 million in a settlement to victims, while insurance paid an additional \$751 million (Ritter). These did not include lawyer fees.

From these figures, we ballparked the potential costs at \$10 million on the Severe end. We took that number divided by 4 to get our ranges for Low, Medium, High, and Severe.

An additional consideration for litigation costs was discovered by the consulting team on 5/12/23 after discussions with Baxter GM, Michael Smith. Smith informed us the cost of watching security cameras 24 hours a day would no longer be covered by the university and would need to be paid by Baxter if it would continue. If the decision to discontinue 24-hour security camera monitoring is made, this could increase the chances for litigation if an attack occurs and could adjust the risk of an attack in our model.

Productivity

Productivity refers to losses due to failure to deliver products or services (Suarez). Following an incident at Baxter Arena, the number of visitors it can accommodate may be reduced, this would mean lower ticket sales. Furthermore, the quality of service may also deteriorate due to damage to equipment. In this case, Baxter Arena will be less productive.

To capture the Productivity costs, we focused the measurement on reduced ticket sales. We found the spectator capacity at Baxter is around 7,800 (Smith and Doctor). We also determined the types of events Baxter hosts from discussions with the GM, Michael Smith. Smith indicated there are 65 athletic events there per year, as well as 15 concerts. From here, we found what the average ticket prices were by event. For athletic events, they range from \$10-\$20 (“Omaha Athletics Announces Hockey Season Ticket Renewals”) and concerts range around \$40-\$200 (Ticketmaster).

We then added an assumption to the model to account for the fact that not all events would be sold out. We assumed athletic events would be at 50% capacity, and concerts would be at 100% capacity. Additionally, we made an assumption that if an attack were to occur, it might not shut Baxter down for a full year. Our Low calculation assumed the venue would only be shut down for 6 months, while the Severe end assumed the venue would be shut down for a full year.

With those things in mind, we get the following calculations:

- Lowest potential loss of productivity = (\$10 per ticket x (7800 spectators x 50% capacity) x 65 athletic events) + (\$40 per ticket x 7800 spectators x 15 concerts) = \$7,215,000/2 (for half a year) = \$3,607,500
- Highets potential loss of productivity = (\$20 per ticket x (7800 spectators x 50% capacity) x 65 athletic events) + (\$200 per ticket x 7800 spectators x 15 concerts) = \$28,470,000

We used the Low end as the floor, and took the Severe end divided by 4 to get our ranges for Low, medium, High, and Severe.

Risk Score Calculation

We started by pairing each asset with each mode of threat (Figure 2). We then scored the sub-dimensions on a scale of 1-4 (Low-Severe) for each pairing. Then we averaged the sub-dimension scores. This gave us an unweighted score for the primary dimensions for each asset/threat pairing.

We then employed a weighting for the primary dimensions, which we multiplied by the unweighted scores. Then we added the weighted primary dimension scores together.

The weighting was primarily done to stress the importance of the Consequences dimension because this dimension was representative of the costs associated with a terrorist attack, which was of primary concern to our client. These weights can and should be adjusted based on the venue being assessed, client need, and as research dictates. For our assessment the weights assigned were Likelihood = .20, Vulnerability = .30, and Consequences = .50.

The formula used for calculating overall risk and the final score ranges are as follows:

- **Risk = Likelihood(w_L) + Vulnerability(w_V) + Consequence(w_C)**
- **Score Ranges:**
 - **Low = 1-1.99**
 - **Medium = 2-2.99**
 - **High = 3-3.99**
 - **Severe = 4**

Analysis and Findings

After assessing the risk for each threat & asset pair using our risk formula, we can conclude that the severity of assessed risks for Baxter Arena ranges between the low to medium category. It should be noted that this assessment only applies to the current state and could change with any changes applied to Baxter's infrastructure, processes, policies, or procedures. External changes would also impact this assessment. For example, if the layout of the grounds around Baxter changes due to construction and/or demolition it will impact how the vulnerability of certain assets are assessed. Additionally, if the location of a certain asset is changed, and if the layout of entry and exits points are altered, it might tip the scales of likelihood of an attack in either direction. The customizability of this risk model allows for reassessment based on changes and modifications of the arena and the surrounding areas. It is because of this feature that this risk model was selected to be utilized for risk assessment of Baxter Arena. In fact, the model should be refreshed and updated regularly for active risk monitoring which will allow for proactive risk mitigation.

Top Five Risks

Risk	Score	Severity
IED on Ammonia Supply	2.71 / 4	MEDIUM RISK
Bomb assault on Ammonia Supply	2.66 / 4	MEDIUM RISK
IED on main utilities	2.47 / 4	MEDIUM RISK
Bomb assault on main utilities	2.42 / 4	MEDIUM RISK
IED assault on propane storage	2.39 / 4	MEDIUM RISK

Table 6. Top 5 risks based on scores calculated using the risk formula

Bomb attacks rank higher overall, and the impact on venue operationally and financially is significant. Specifically, an indoor attack with an IED would be devastating in terms of loss of life and financial impact. An IED attack is also one of the most likely attacks to occur. An IED attack coupled with damage to the ammonia system could prove even more deadly. The likelihood is offset by the fact the main controls for the ammonia system are in a restricted area, however, the system runs throughout the venue to get refrigerant to the ice rink, so a bomb attack does not need to be near the controls to create a major leak. Although bomb attacks could result in the most severe consequences, the risk of propane supply also poses a substantial risk. It is exposed outside and is near a service entrance. This makes it vulnerable to all threat types examined.

The financial impact of an attack at Baxter arena is one of the main factors in the risk formula. This would fall under the consequences which weigh 50% in the risk equation. The financial impact ranges between \$3 million to \$18 million for a low severity attack, and it ranges between \$55 million to \$75 million (potentially more) for a severe attack. Factors considered for the financial impact include potential for decrease in enrollment, medical costs, insurance costs, settlement payouts to victims, repair costs, and financial loss from inability to continue operations. Utilities, including water, gas, electricity, and internet connection, are essential and necessary for any building to be able to operate. Any disruption to the smooth operation of these utilities would halt the operations of any building. For example, if water and sewer pipes broke due to a bomb or IED blast, it would cause the building to flood, evacuation would be necessary, clean up would be required, and repairs would need to be made. If electrical circuits fail or break during an attack, it will kill the power to the whole building. Today's modern and secure buildings that require badge access doors and have 24-hour security cameras, would fail to operate if electricity is lost. Although backup generators are present at Baxter, the assumption is that if the attackers are planning to disable the electrical system in the building, disabling the backup generators would be "part of the plan."

Assumptions and Limitations of Findings

During our research, we relied on some assumptions and were faced with limitations due to time constraints and availability of multiple sources of data to be able to verify some information. However, the legitimacy of the report and reliability of finding do not suffer because of this.

These restrictions merely limited the scope and extent of our research. For example, we were able to get a good range for the financial impact based on the severity of the attack, however, acquiring line by line detail was not possible due to scarcity of time and availability of resources. We did reach our sources for repair estimates, however, repair of this magnitude requires more time to be able to carefully assess and estimate the costs.

Another limitation to the accurate ranking of score was for the sub-dimension of “location.” Without data that summarizes attempted attacks on Omaha, the Aksarben area, or Baxter itself, it is difficult to gauge the political climate of the area. Since there have not been any recent major terrorist events, location was based on the location of the asset in Baxter. Ideally, this sub-dimension would reflect the likelihood of the asset/threat pair outside of just its relationship to the building itself.

Next Steps

Reaffirming Team One’s recommendation, Baxter arena should continue to follow the short term and long-term recommendations. There is no one single answer or method to solve all the security concerns in any arena. The best approach to risk mitigation is to actively monitor risk and continually update policies and procedures. We encourage Baxter arena to continuously gather updated inputs and sources as they become available and adjust weights and values for the risk formula with as new changes occur.

The risk scoring method is a useful tool for risk assessment and can be applicable to any venue configuration. Special attention should be paid when identifying vulnerable assets in conjunction with external or internal threats as those will be different for other venues. Additionally, weights for likelihood, vulnerability, and consequence, used for Baxter arena will not be the same for any other venue and should be reassessed to be representative of the other venue, respectively.

References

- Antonio, San, et al. *Sport Event Risk Management Emergency Management in Higher Education Meeting Department of Education NCS4 Workshop Demonstration*. 2009.
- Association of the United States Army. "The Role of Drones in Future Terrorist Attacks." *AUSA*, 26 Feb. 2021, www.ausa.org/publications/role-drones-future-terrorist-attacks.
- Beyer, Don. *The Economic Toll of Gun Violence*.
www.jec.senate.gov/public/_cache/files/69fcc319-b3c9-46ff-b5a6-8666576075fe/the-economic-toll-of-gun-violence-final.pdf.
- Brodeur, Abel, and Hasin Yousaf. "The Economics of Mass Shootings." *SSRN Electronic Journal*, 2019, <https://doi.org/10.2139/ssrn.3483966>.
- Burley, John. *THE AMMONIA QUESTION for ICE RINKS RISKS & REWARDS Ammonia Refrigerant and U.S. Safety Standards Industry Expert Report*.
- Command, Control and Interoperability Center for Advanced Data Analysis (CCICADA) *BEST PRACTICES in Anti-Terrorism Security for Sporting and Entertainment Venues RESOURCE GUIDE*. 2013.
- "Commercial Construction Costs per Square Foot [2023] | ProEst." *Proest.com*, 1 June 2021, proest.com/construction/cost-estimates/commercial-costs-per-square-foot/#:~:text=Major%20systems%2F%20Utilities&text=HVAC%20takes%20up%20an%20overall. Accessed 15 May 2023.
- "Cost & Aid | Undergraduate Office of Admissions | University of Nebraska–Lincoln." *Admissions.unl.edu*, 2023, admissions.unl.edu/cost/#resident-tuition.
- DeNolf, Renee L, and Chadi I Kahwaji. "EMS, Mass Casualty Management." *Nih.gov*, StatPearls Publishing, 25 Feb. 2019, www.ncbi.nlm.nih.gov/books/NBK482373/.
- Department of Health and Human Services. *STATE of NEBRASKA ROSTER HOSPITALS General Acute Hospitals Critical Access Hospitals Rehabilitation Hospitals Psychiatric Hospitals*. 13 Apr. 2023.
- Department of Homeland Security. *A Guide to Critical Infrastructure and Key Resources Protection at the State, Regional, Local, Tribal, and Territorial Level*. 2008.
- "National Terrorism Advisory System Bulletin - June 7, 2022 | Homeland Security." *Www.dhs.gov*, 7 June 2022, www.dhs.gov/ntas/advisory/national-terrorism-advisory-system-bulletin-june-7-2022.
- Planning Considerations: Complex Coordinated Terrorist Attacks*. 2018.
- Vulnerability Assessment Report*. Office of Domestic Preparedness, July 2003.
- Department of Homeland Security: Science and Technology. "Feature Article: Software Suite Will Harden Defenses for Soft Targets | Homeland Security." *Www.dhs.gov*, 3 Nov. 2022, www.dhs.gov/science-and-technology/news/2022/11/03/feature-article-software-suite-will-harden-defenses-soft-targets.

- Ezell, Barry Charles, et al. "Probabilistic Risk Analysis and Terrorism Risk." *Risk Analysis*, vol. 30, no. 4, Apr. 2010, pp. 575–589, <https://doi.org/10.1111/j.1539-6924.2010.01401.x>.
- FEMA. *National Prevention Framework Second Edition*. 2016.
- Fischenich, Mark. "Civic Center Ice Project to Cost \$2.66M." *Mankato Free Press*, 28 Sept. 2021, www.mankatofreepress.com/news/local_news/civic-center-ice-project-to-cost-2-66m/article_a58856ea-1fdd-11ec-a70e-6b54c0116026.html. Accessed 15 May 2023.
- "Frequently Asked Questions | Athletics | University of Nebraska Omaha." www.unomaha.edu, www.unomaha.edu/athletics/arena/faq.php#:~:text=The%20cost%20of%20Baxter%20Arena. Accessed 15 May 2023.
- Hall, Stacey, et al. "Introducing a Risk Assessment Model for Sport Venues." *The Sport Journal*, U.S. Sports Academy, 14 Mar. 2008, thesportjournal.org/article/introducing-a-risk-assessment-model-for-sport-venues/.
- Hesterman, Jennifer. *Soft Target Hardening: Protecting People from Attack*. 18 Dec. 2014. Accessed 15 May 2023.
- "How Much Do Commercial Generators Cost? | PriceItHere.com." *PriceItHere.com*, priceithere.com/commercial-generator-prices/.
- Johnson, Jenna. "Report: Virginia Tech Massacre Cost \$48.2 Million." *Washington Post*, 13 Apr. 2012, www.washingtonpost.com/blogs/campus-overload/post/report-virginia-tech-massacre-cost-482-million/2012/04/13/gIQAdDmxET_blog.html.
- Lafre, Gary, and Laura Dugan. *78% 22% Terrorist Attacks in the U.S between 1970 and 2013: Data from the Global Terrorism Database (GTD) Project Investigators*. Nov. 2014.
- Nebraska Department of Environment and Energy. "Nebraska's Average Residential Price of Propane." *Neo.ne.gov*, 2023, neo.ne.gov/programs/stats/inf/86.html. Accessed 15 May 2023.
- "Omaha Athletics Announces Hockey Season Ticket Renewals." *University of Nebraska Omaha Athletics*, 15 May 2020, omavs.com/news/2020/5/12/omaha-athletics-announces-hockey-season-ticket-renewals. Accessed 15 May 2023.
- Omar, Mona. *Draft Report on Negative Effects of Terrorism on the Enjoyment of Human Rights*. Human Rights Council, 19 July 2018.
- Ordway, Denise-Marie, et al. "How School Shootings Hurt Student Achievement and Enrollment." *The Journalist's Resource*, 28 Mar. 2023, journalistsresource.org/education/school-shootings-student-achievement/#:~:text=They%20were%205.5%20percentage%20points. Accessed 15 May 2023.
- Mears, Bill. "Virginia Tech Mass Shooting Lawsuit Dismissed." CNN, 31 Oct. 2013, www.cnn.com/2013/10/31/justice/virginia-tech-shooting-negligence-lawsuit/index.html.

- Rahman, Grace R. et al. Terrorist Attacks against Sports Venues: Emerging Trends and Characteristics Spanning 50 Years. National Library of Medicine, National Center for Biotechnology Information. March 2023. <https://pubmed.ncbi.nlm.nih.gov/36938664/>
- Ritter, Ken. "Court OK's \$800M Settlement for MGM Resorts, Vegas Victims." *AP NEWS*, 30 Sept. 2020, apnews.com/article/lawsuits-shootings-las-vegas-mass-shooting-nevada-las-vegas-cd07b4640a5a8e6d32ccbcd1aae2e65.
- Ross, Sean. "How Terrorism Damages the Global Economy." *Investopedia*, 24 June 2022, www.investopedia.com/articles/markets/080216/top-5-ways-terrorism-impacts-economy.asp#:~:text=The%20most%20obvious%20is%20the. Accessed 15 May 2023.
- Saxton, Jim. *THE ECONOMIC COSTS of TERRORISM Executive Summary the ECONOMIC COSTS of TERRORISM*. 2002.
- security, 911. "Stadium UAS Risk Assessment Guidelines." *Www.911security.com*, www.911security.com/learn/airspace-security/risk-assessment-guideline/stadiums. Accessed 15 May 2023.
- "Settlement Reached in Virginia Tech Shootings." *NBC News*, 10 Apr. 2008, www.nbcnews.com/id/wbna24050712. Accessed 15 May 2023.
- Smith, Lisa. "Will Filing an Insurance Claim Raise Your Rates?" *Investopedia*, 24 Aug. 2021, www.investopedia.com/articles/pf/08/claim-raise-rates.asp#:~:text=Filing%20a%20claim%20often%20results. Accessed 15 May 2023.
- Smith, Michael, and Dr. Austin Doctor. *MBA Capstone - Consulting Meetings*. 2023.
- Suarez, Teresa. "A Crash Course on Capturing Loss Magnitude with the FAIR Model." *Www.fairinstitute.org*, 20 Oct. 2017, www.fairinstitute.org/blog/a-crash-course-on-capturing-loss-magnitude-with-the-fair-model. Accessed 15 May 2023.
- "Ticketmaster: Buy Verified Tickets for Concerts, Sports, Theater and Events." *Ticketmaster*, www.ticketmaster.com/.
- U.S. Congress Joint Economic Committee. *A State-By-State Examination of the Economic Costs of Gun Violence*. 18 Sept. 2019.
- U.S. Department of Homeland Security. *Risk Management Fundamentals Homeland Security Risk Management Doctrine*. Apr. 2011.
- U.S. Department of State. "Country Reports on Terrorism 2021 - United States Department of State." *United States Department of State*, Mar. 2023, www.state.gov/reports/country-reports-on-terrorism-2021/.
- U.S. Department of State. "Distribution of Attack Types Used in Acts of Terrorism Worldwide in 2021." Statista, Statista Inc., 30 Sep 2022, <https://www-statista-com.leo.lib.unomaha.edu/statistics/622492/attack-types-used-terrorist-attacks-worldwide/>
- United Nations - Office on Drugs and Crime. "Terrorism and Conventional Weapons." [Www.unodc.org](https://www.unodc.org/),

www.unodc.org/images/odccp/terrorism_weapons_conventional.html#:~:text=Terrorists%20use%20both%20explosive%20bombings.

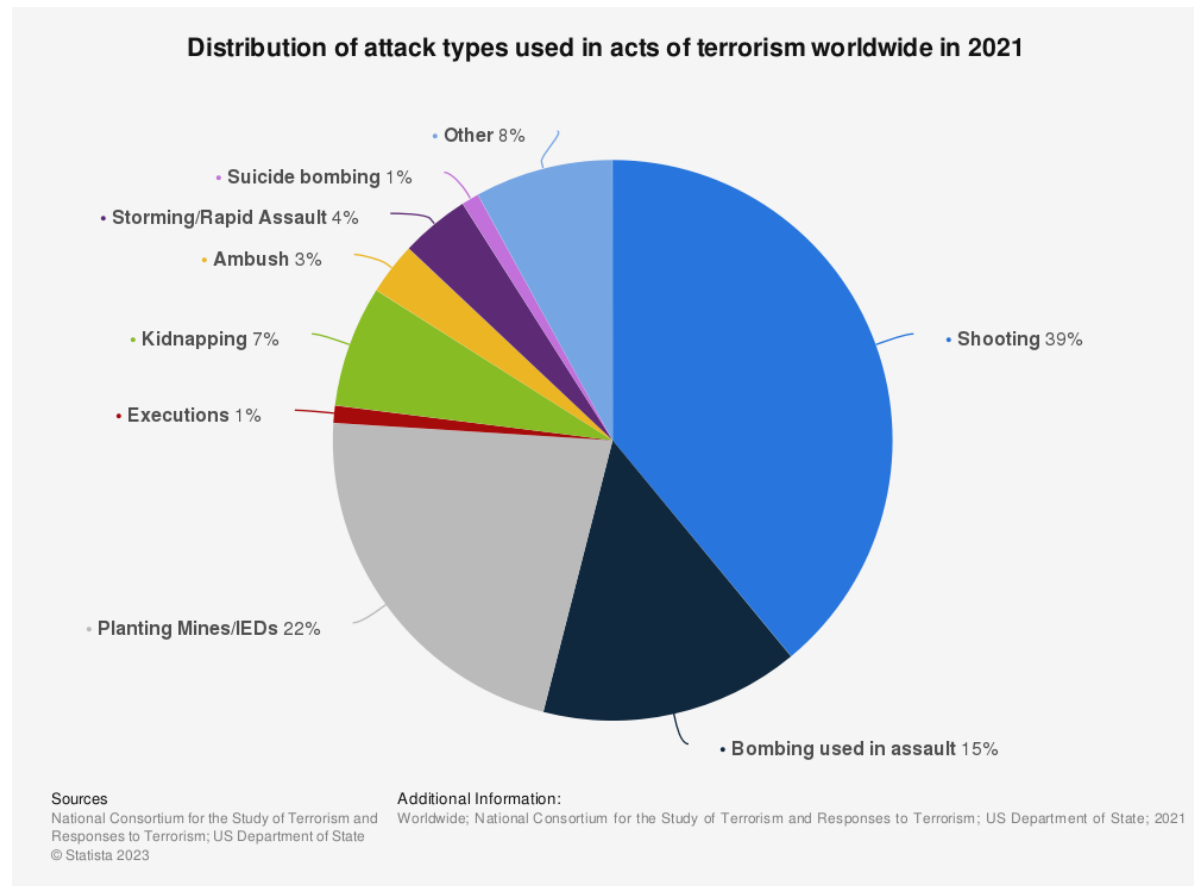
“University of Nebraska Omaha Tuition & Financial Aid.” *U.S. News*, 2023, www.usnews.com/best-colleges/university-of-nebraska-omaha-2554/paying#:~:text=University%20of%20Nebraska%20Omaha's%20tuition,of%20Nebraska%20Omaha%20is%20cheaper.

University of Nebraska System. *Annual Comprehensive Financial Report*. 16 Dec. 2022, nebraska.edu/-/media/projects/unca/offices-policies/business-and-finance-office/docs/accounting-finance/acfr-2022.pdf.

“University of Nebraska System Fall Enrollment Is 49,560.” *Nebraska.edu*, 7 Sept. 2022, nebraska.edu/news-and-events/news/2022/09/university-of-nebraska-system-fall-enrollment-is-49560.

Appendix

Figure 1



Risk Scoring

Figure 2: Likelihood Sub-Dimension Scoring

Asset/ Threat Pair	Frequency	Comparative Attacks	Location	Ideology	Score	Weighted Score
Backup Generator+ Firearms - Assault	2	3	1	1	1.75	0.35
Backup Generator+ Bomb - Assault	2	3	3	1	2.25	0.45
Backup Generator+ Bomb - IED	3	3	3	1	2.50	0.50
Backup Generator+ Bomb - IED/Drone	2	2	3	1	2.00	0.40
Backup Generator+ Bomb - IED/Vehicle Ramming	1	3	2	1	1.75	0.35
Backup Generator+ Vehicle Ramming	1	3	2	1	1.75	0.35
Ammonia supply & system+ Firearms - Assault	2	3	1	1	1.75	0.35
Ammonia supply & system+ Bomb - Assault	2	3	3	1	2.25	0.45
Ammonia supply & system+ Bomb - IED	3	3	3	1	2.50	0.50
Ammonia supply & system+ Bomb - IED/Drone	1	2	3	1	1.75	0.35
Ammonia supply & system+ Bomb - IED/Vehicle Ramming	1	3	2	1	1.75	0.35
Ammonia supply & system+ Vehicle Ramming	1	3	2	1	1.75	0.35
Propane storage+ Firearms - Assault	3	3	1	1	2.00	0.40
Propane storage+ Bomb - Assault	3	3	3	1	2.50	0.50
Propane storage+ Bomb - IED	3	3	3	1	2.50	0.50
Propane storage+ Bomb - IED/Drone	3	2	3	1	2.25	0.45
Propane storage+ Bomb - IED/Vehicle Ramming	4	3	2	1	2.50	0.50
Propane storage+ Vehicle Ramming	4	3	2	1	2.50	0.50
Utilities - main electrical, gas, water+ Firearms - Assault	2	3	1	1	1.75	0.35
Utilities - main electrical, gas, water+ Bomb - Assault	2	3	3	1	2.25	0.45
Utilities - main electrical, gas, water+ Bomb - IED	3	3	3	1	2.50	0.50
Utilities - main electrical, gas, water+ Bomb - IED/Drone	1	2	3	1	1.75	0.35

Utilities - main electrical, gas, water+ Bomb - IED/Vehicle Ramming	1	3	2	1	1.75	0.35
Utilities - main electrical, gas, water+ Vehicle Ramming	1	3	2	1	1.75	0.35

Figure 3: Vulnerability Sub-Dimension Scoring

Asset/ Threat Pair	Visibility	Criticality	Capacity	Casualties	Adjacent Impact	CBRNE Elements	Accessibility	Score	Weighted Score
Backup Generator+ Firearms - Assault	2	2	1	1	2	1	3	1.71	0.51
Backup Generator+ Bomb - Assault	2	2	1	1	3	1	3	1.86	0.56
Backup Generator+ Bomb - IED	2	2	1	1	3	2	3	2.00	0.60
Backup Generator+ Bomb - IED/Drone	2	2	1	1	3	3	3	2.14	0.64
Backup Generator+ Bomb - IED/Vehicle Ramming	2	2	1	1	3	2	3	2.00	0.60
Backup Generator+ Vehicle Ramming	2	2	1	1	3	1	3	1.86	0.56
Ammonia supply & system+ Firearms - Assault	1	3	3	1	1	2	2	1.86	0.56
Ammonia supply & system+ Bomb - Assault	1	3	4	4	2	3	2	2.71	0.81
Ammonia supply & system+ Bomb - IED	1	3	4	4	2	3	2	2.71	0.81

Ammonia supply & system+ Bomb - IED/Drone	1	3	1	2	3	3	1	2.00	0.60
Ammonia supply & system+ Bomb - IED/Vehicle Ramming	1	3	1	2	3	2	1	1.86	0.56
Ammonia supply & system+ Vehicle Ramming	1	3	1	1	3	1	1	1.57	0.47
Propane storage+ Firearms - Assault	3	2	2	1	3	1	3	2.14	0.64
Propane storage+ Bomb - Assault	3	2	2	1	3	2	3	2.29	0.69
Propane storage+ Bomb - IED	3	2	2	1	3	2	3	2.29	0.69
Propane storage+ Bomb - IED/Drone	3	2	2	1	3	3	3	2.43	0.73
Propane storage+ Bomb - IED/Vehicle Ramming	3	2	2	1	3	2	3	2.29	0.69
Propane storage+ Vehicle Ramming	3	2	2	1	3	2	3	2.29	0.69
Utilities - main electrical, gas, water+ Firearms - Assault	2	3	2	1	1	2	2	1.86	0.56
Utilities - main electrical, gas, water+ Bomb - Assault	2	3	3	3	2	3	2	2.57	0.77
Utilities - main electrical, gas,	2	3	3	3	2	3	2	2.57	0.77

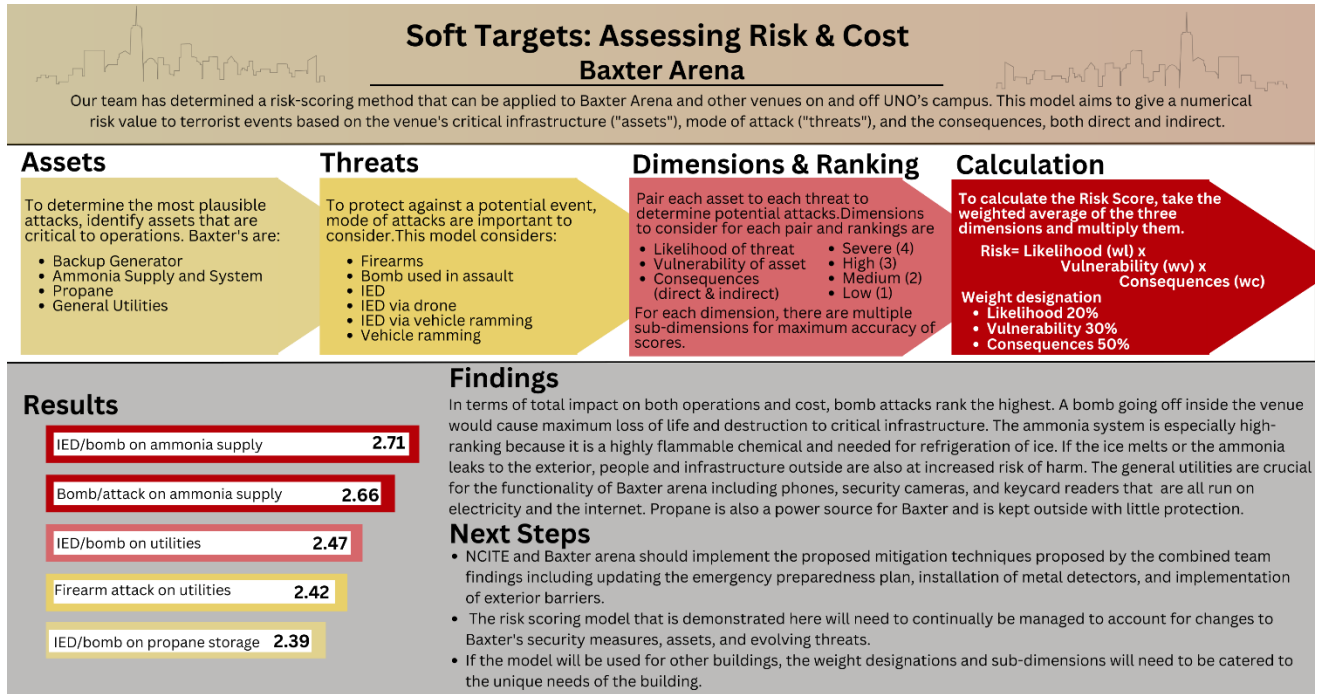
water+ Bomb - IED									
Utilities - main electrical, gas, water+ Bomb - IED/Drone	2	3	2	1	3	3	1	2.14	0.64
Utilities - main electrical, gas, water+ Bomb - IED/Vehicle Ramming	2	3	2	1	3	2	1	2.00	0.60
Utilities - main electrical, gas, water+ Vehicle Ramming	2	3	2	1	3	1	1	1.86	0.56

Figure 4: Consequences Sub-Dimension Scoring

Threat/Asset Pairs	Reputation	Response	Replacement	Fines	Productivity	Scores	Weighted Score
Backup Generator+ Firearms - Assault	3	2	2	2	1	2.00	1.00
Backup Generator+ Bomb - Assault	2	3	2	1	1	1.80	0.90
Backup Generator+ Bomb - IED	2	3	2	1	1	1.80	0.90
Backup Generator+ Bomb - IED/Drone	1	2	2	1	1	1.40	0.70
Backup Generator+ Bomb - IED/Vehicle Ramming	2	3	2	1	1	1.80	0.90
Backup Generator+ Vehicle Ramming	1	1	2	1	1	1.20	0.60
Ammonia supply & system+ Firearms - Assault	3	2	3	2	2	2.40	1.20
Ammonia supply & system+ Bomb - Assault	3	3	3	2	3	2.80	1.40
Ammonia supply & system+ Bomb - IED	3	3	3	2	3	2.80	1.40
Ammonia supply & system+ Bomb - IED/Drone	1	3	3	2	2	2.20	1.10
Ammonia supply & system+ Bomb - IED/Vehicle Ramming	2	3	3	2	3	2.60	1.30

Ammonia supply & system+ Vehicle Ramming	1	2	3	2	2	2.00	1.00
Propane storage+ Firearms - Assault	3	2	2	2	3	2.40	1.20
Propane storage+ Bomb - Assault	2	3	3	1	3	2.40	1.20
Propane storage+ Bomb - IED	2	3	3	1	3	2.40	1.20
Propane storage+ Bomb - IED/Drone	1	3	3	1	3	2.20	1.10
Propane storage+ Bomb - IED/Vehicle Ramming	2	3	3	1	3	2.40	1.20
Propane storage+ Vehicle Ramming	1	2	3	1	3	2.00	1.00
Utilities - main electrical, gas, water+ Firearms - Assault	3	1	2	2	2	2.00	1.00
Utilities - main electrical, gas, water+ Bomb - Assault	2	2	4	1	3	2.40	1.20
Utilities - main electrical, gas, water+ Bomb - IED	2	2	4	1	3	2.40	1.20
Utilities - main electrical, gas, water+ Bomb - IED/Drone	1	2	4	1	3	2.20	1.10
Utilities - main electrical, gas, water+ Bomb - IED/Vehicle Ramming	2	2	4	1	3	2.40	1.20
Utilities - main electrical, gas, water+ Vehicle Ramming	1	1	3	1	2	1.60	0.80

Infographic



Glossary

<i>Assets</i>	Critical pieces of infrastructure for Baxter. Things, if damaged, would dramatically impact Baxter's ability to operate.
<i>Threats</i>	Type of attacks that may occur
<i>Likelihood</i>	The chances a threat will occur
<i>Vulnerability</i>	Characteristics of the assets that could lead to greater "success" for a threat, including potential loss of life
<i>Consequences</i>	The negative results following an attack, including economic impact
<i>Firearm - Assault</i>	Active shooter, proximity to victims, on foot
<i>Bomb - Assault</i>	Like active shooter but weapon of choice is explosives, military grade, not homemade
<i>Bomb - IED</i>	Improvised Explosive Devices - inclusive of incendiaries, suicide bombing, planted bombs
<i>Bomb - IED/Drone</i>	IED's delivered via drone
<i>Bomb - IED/vehicle ramming</i>	IED's delivered via vehicle by driving into crowd or building
<i>Vehicle Ramming</i>	Using a vehicle to ram into victims, no presence of a bomb
Likelihood:	
<i>Frequency</i>	Most common attacks in general
<i>Comparative attacks</i>	Likelihood of attack on university or similar venue
<i>Location</i>	Likelihood of attack in venue area/state, and/or physical placement of venue
<i>Ideology</i>	Event based metric. Does the event represent a symbol or ideology that might increase the likelihood of attack?
Vulnerability:	
<i>Visibility</i>	The awareness of existence and visibility of asset to the public

<i>Criticality/Dependency</i>	How critical is the asset to Baxter? How would it impact Baxter's ability to operate?
<i>Capacity</i>	Potential venue population capacity. Proximity of asset to population and method of attack are considered.
<i>Casualties</i>	Potential for mass casualty incident (MCI) as defined by National Library of Medicine
<i>Adjacent Impact</i>	Impact outside of the venue
<i>CBRNE Elements</i>	Chemical, Biological, Radiological, Nuclear & Explosive. Presence of legal WMD on site.
<i>Accessibility</i>	The availability of the asset for ingress and egress by a potential threat.
Consequences:	
<i>Reputation</i>	Negative connotation surrounding UNO/Baxter as the result of an attack - primarily measured by decrease in enrollment
<i>Response</i>	Costs and actions of UNO/Baxter immediately following an attack, viewed as "first response" - primarily measured by medical costs and amount of insurance claims
<i>Replacement</i>	Cost of repairing/replacing infrastructure following an attack
<i>Fines</i>	Cost of litigation, increase in insurance premiums, and/or defects in original construction discovered following an attack
<i>Productivity</i>	Cost of Baxter's inability to continue normal operations following an attack - primarily measured by decrease in events/ticket sales