

LNG and Petrochemical Security Risk Assessment and Management

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David A. Moore, PE, CSP
AcuTech Consulting Group
2001 North Beauregard Street
Suite 100
Alexandria, VA 22311
703-598-3921
www.acutech-consulting.com



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David Moore is the President and CEO of the AcuTech Consulting Group, a security and safety consulting firm based in Alexandria, Virginia. Mr. Moore was the lead author of the AIChE CCPS® “Guidelines for Managing and Analyzing the Security Vulnerabilities of Fixed Chemical Sites”, the security guidelines for the American Petroleum Institute (API, the developer of the API)/National Petrochemical and Refiners Association (NPRA) Security Vulnerability Assessment Methodology, and the developer of the Tier 4 SVA guidelines for the Responsible Care® Security Code for the American Chemistry Council (ACC).

He is a frequent speaker on security, process safety management, human factors, and inherent safety for the petroleum and chemical industry. His firm is actively involved in chemical process security and safety consulting and training. He has provided risk consulting services and training to industrial facilities worldwide, including oil refineries, chemical plants, pipelines, and manufacturing plants. Mr. Moore has taught process safety and security courses for over 15 years to many of the world’s largest corporations. He is an instructor on process safety and security for AIChE, API, OSHA, USEPA, and the NPRA.

Mr. Moore was formerly a Senior Engineer with Mobil Corporation; and a Fire Protection Engineer with the National Fire Protection Association. He has been consulting in the industry since 1987.

Mr. Moore is a Registered Professional Engineer. He serves on the AIChE Center for Chemical Process Safety Technical Steering Committee, the CCPS Plant Security Committee, the Canadian Chemical Producer’s Association PSM Committee, and the Mary Kay O’Connor Process Safety Center at Texas A&M University. He has an MBA, (NYU-1987), and a B.Sc., Fire Protection Engineering (University of Md.-1979).

At Issue: The Challenge of Making Risk Decisions for Port Security



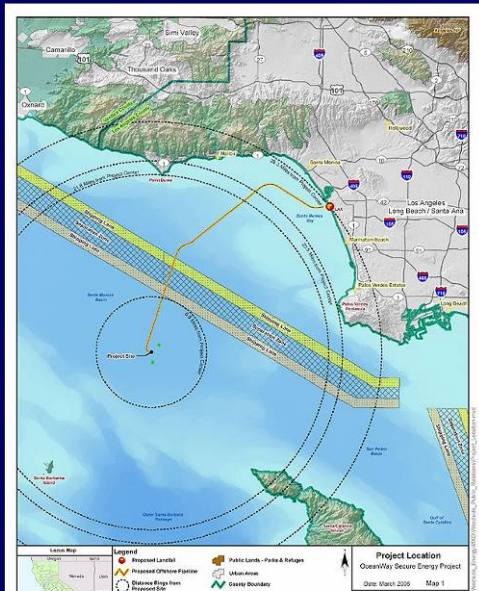
Topics

- Actual risks v. risk perception
- Requirements and processes for risk assessment and management
- Port business interruption and business continuity planning
- Implications and future considerations



LNG Siting - National Issues

- Public concerns of terrorism is a major factor in LNG import terminal siting
- LNG industry does not have a standard security vulnerability assessment methodology to help analyze and explain these risks consistently.



LNG Buildout Challenges

- Build-out of LNG infrastructure in a post 9/11 security environment is challenging
- Conflict between new security concerns and commerce as usual that has to be rationalized
- Despite excellent safety record, terrorism is predominant issue



HAZMAT Issues

- *Perceived* by the public to be:
 - attractive terrorist targets and
 - vulnerable to attack
- Usual focus is on potential consequences only whereas *risk* is the issue
- Possibly could lead to commercial paralysis
- Must be put into perspective and dealt with appropriately through risk management

Overstatement of Consequences



LNG and Petrochemical Port Security Issues

- All transportation systems are seen as vulnerable and credible targets
- In particular, hazardous materials are emphasized due to potential consequences
- Concerns – collateralization of HAZMAT to injure third parties, cause port infrastructure damage, create port closures, cause environmental damage



Chemical Facility Security Regulations

- Senate unanimously accepted a chemical facility security amendment to the 2007 DHS appropriations bill
- Gives DHS authority to issue “interim final regulations that establish homeland security requirements, including minimum standards and required submission of facility security plans to the Secretary, for chemical facilities that the Secretary determines present the greatest security risk and that are not currently regulated under Federal law for homeland security purposes”

Sandia/DOE Study* Conclusion

- Risks can be responsibly managed through a combination of approaches:
 - Improve risk prevention measures
 - Earlier ship interdiction
 - Boardings and searches
 - Positive vessel control during transit
 - Port traffic control measures
 - Safety and security zones and surveillance;
 - Emergency response planning

* Sandia National Laboratories, December 2004

Mission Ahead – Risk Management

- Post 9/11 challenge is to sort out misunderstandings from real risks and to manage security going forward
- LNG must be secure commensurate with the risk
- Lifecycle risk management is required



Multitude of Homeland Security Risks



Similar Challenges

- LNG is not the only transportation or hazardous materials security issue being challenged today
 - Air
 - Rail transportation
 - Chemical plants
 - Nuclear



Example of a New Risk - A380

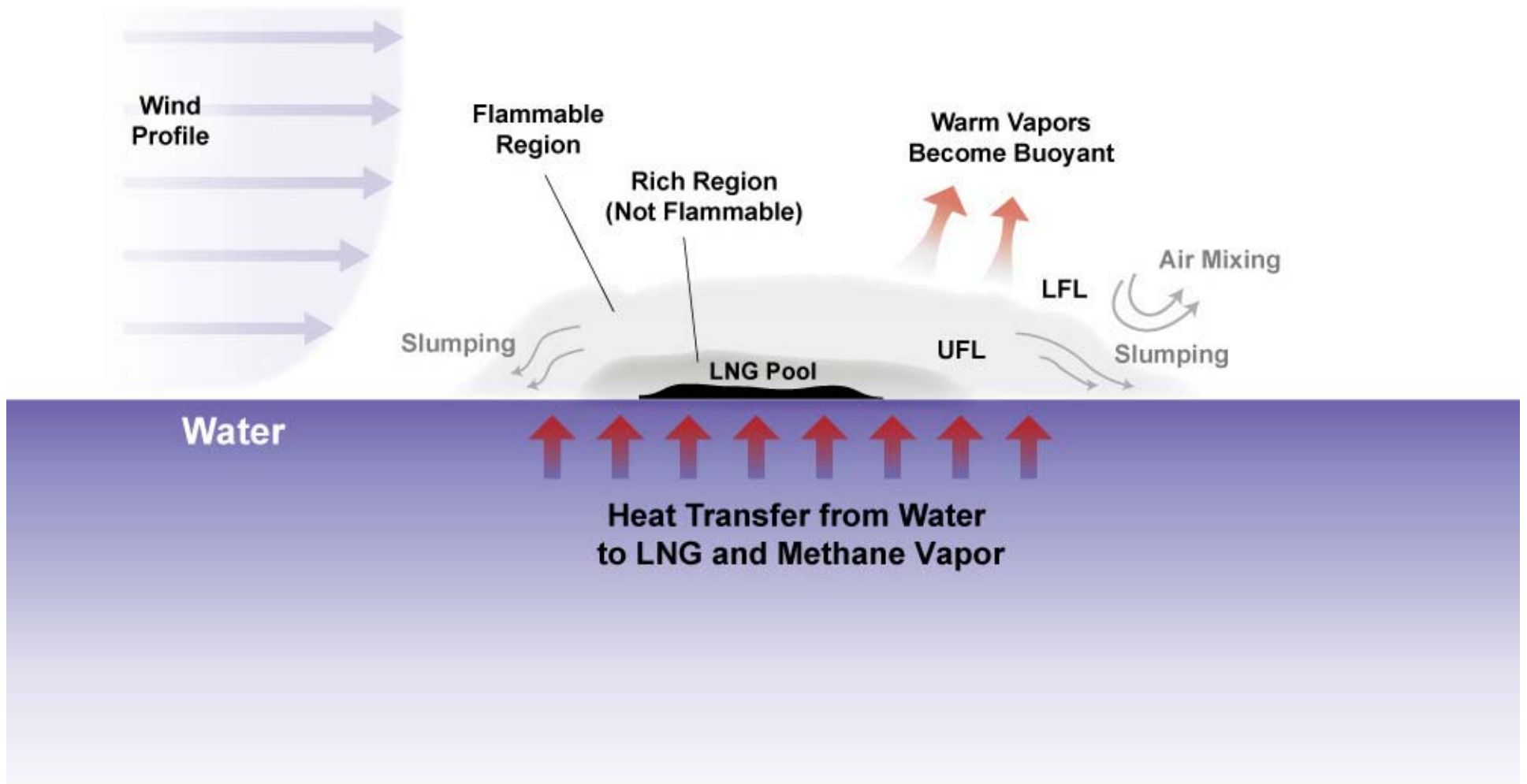
- Largest airliner ever built
 - 555-840 passengers (30% increase over B747)
 - Wing span - 261' 10"
 - Length - 239' 6"
 - Height - 79' 1"
- Acceptable risk?
- Potential use as a weapon?



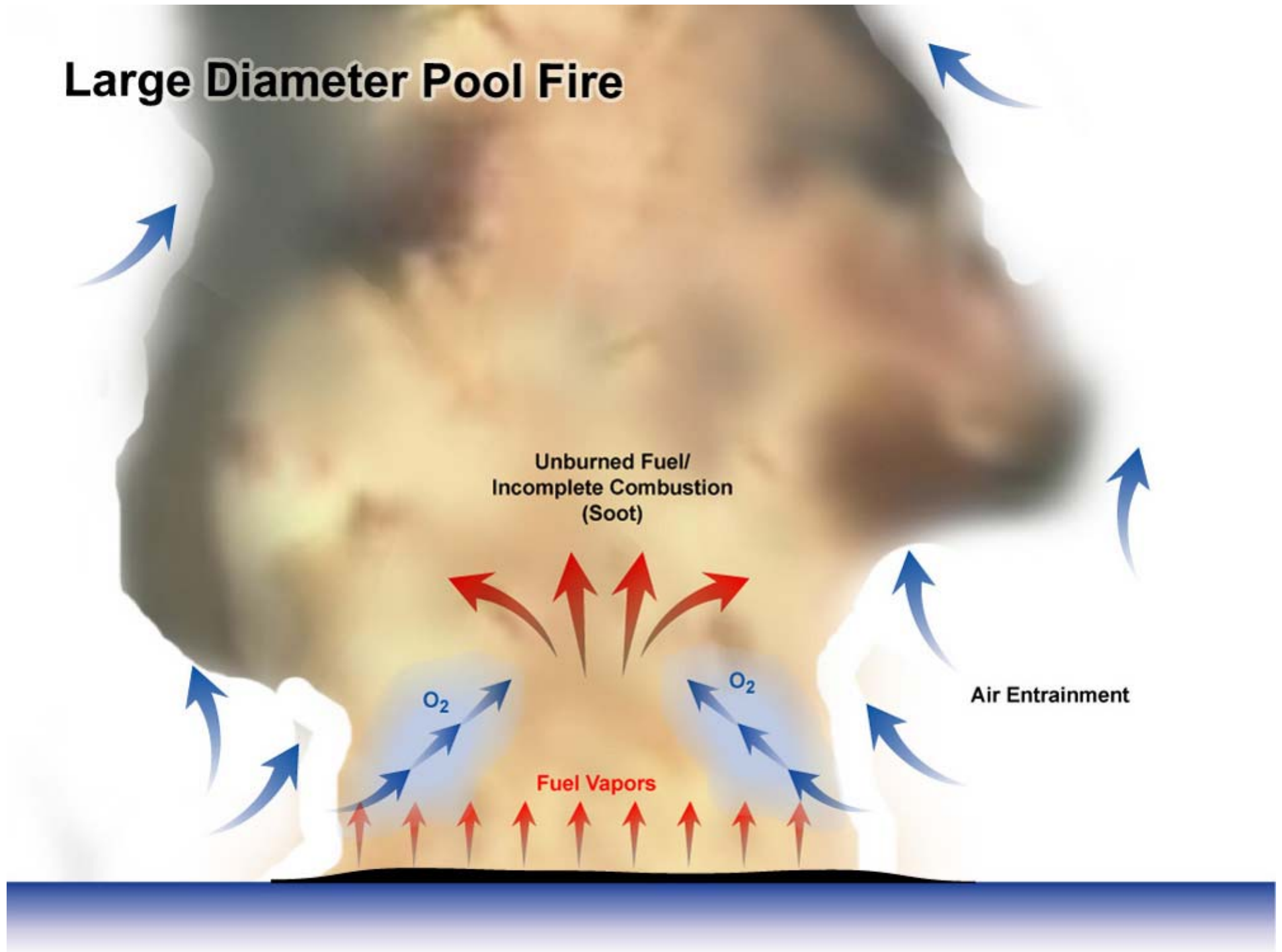
Acceptable Risk - How Secure is Secure Enough?

- Today industry is facing issues of acceptable risk without a clear threat or limit.
- Facilities cannot prevent or protect against all known or suspected threats,
- There are reasonable measures and approaches that can be taken for certain threats, but...
- Beyond that upper limit, facilities need to seek out assistance and coordinate efforts with law enforcement agencies for adversary intervention.

Pool on Water



Large Diameter Pool Fire



A major release of LNG most likely ignite on site

- An ignitable vapor cloud within the Port has a high probability of ignition
- A major breach of the LNG storage would likely include an ignition source at the site.



Flammable Vapor Cloud Ignition



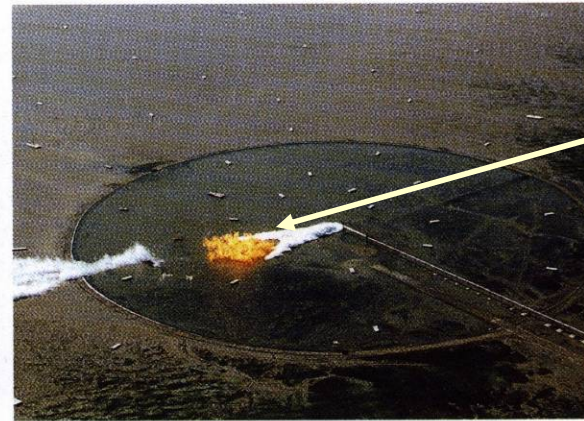
(a)



(b)



(c)

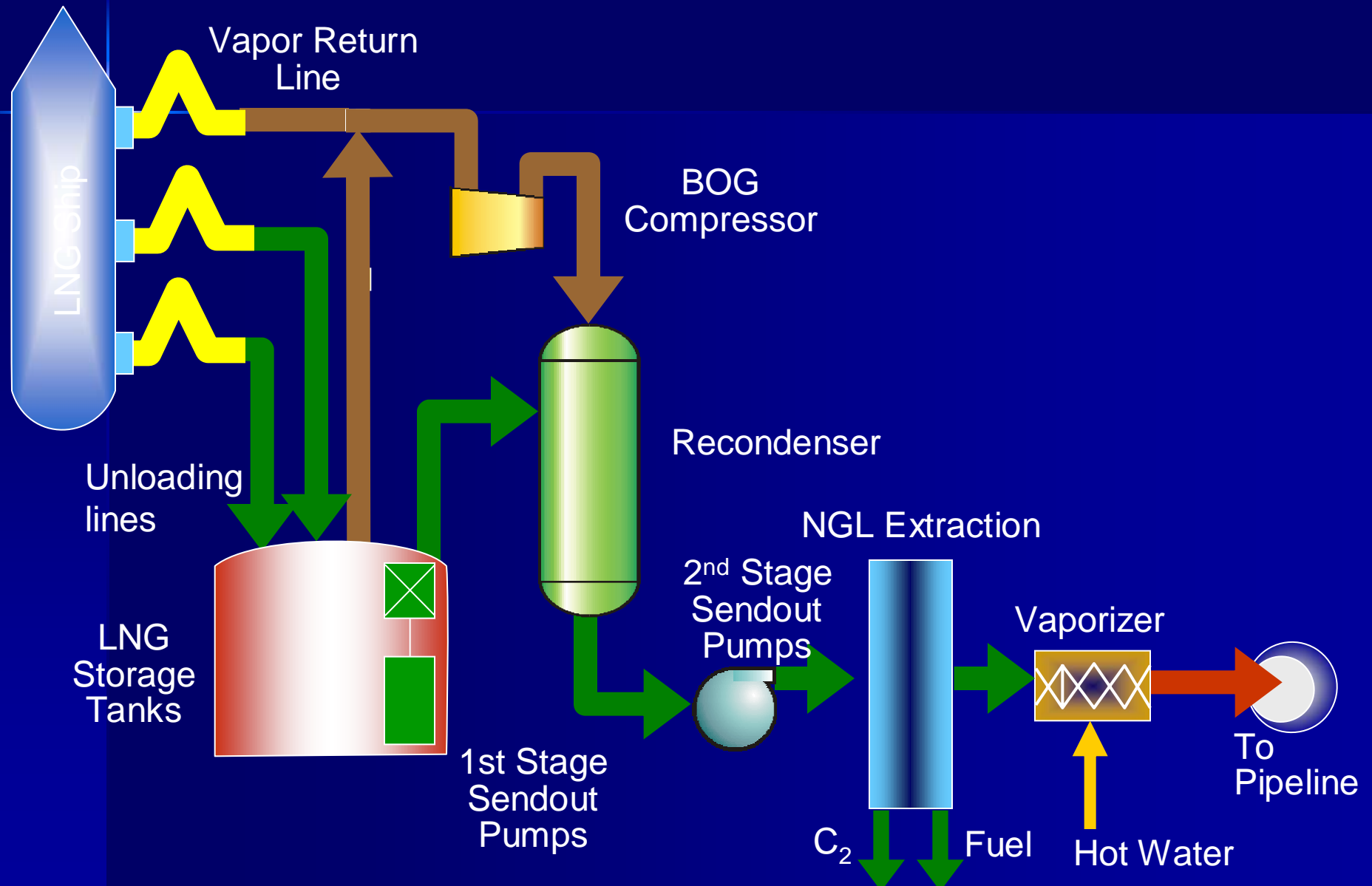


(d)

Flame does not spread to the entire cloud

Plate 9 Maplin Sands trials of combustion of vapour clouds (Blackmore, Eyre and Summers, 1982; Hirst and Eyre, 1983): Trial 27: times from ignition: (a) 0 seconds; (b) 9 seconds; (c) 14 seconds; and (d) 16 seconds. Release of 32 m³/min with wind speed 6 m/s (Reproduced by permission of Shell Research Ltd)

LNG Terminal Flow Diagram



Refinery Damage



Israeli-Lebanese Conflict 2006

- Port of Haifa targeted including Refining and Petrochemical complex
- Military-style provisions for business continuity not common in US
- Port inbound closure required



1600

NFPA 1600
Standard on
Disaster/Emergency
Management and
Business Continuity
Programs
2004 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

LNG SVA Requirements

Ship	33 CFR Part 104 and ISPS ISPS Code
Transportation by Ship in U.S. Waters	Waterway Suitability Assessments - NVIC 05-05
Transportation by Truck	DOT HM-232
Transportation by Pipeline	DOT Security Guidance and future regs under DHS/DOT/PHMSA
Terminal	33 CFR Part 105

ISSUES

- US needs to develop a common security vulnerability assessment framework for decision-making
- Multiple SVA methods (>100) for different sectors
- Lack of common risk terminology
- Lack of guidance on threat assumption
- Lack of consensus on risk evaluation criteria
- Lack of a calibrated list of critical assets to apply method to on a high priority basis
- Most critical assets in the US are privately owned

RAMCAP Concept Development

■ Purpose:

- Develop a common risk-based method for comparing security risk across sectors of US infrastructures and key resources
- Determine vulnerabilities
- Determine need for national security upgrades and specific infrastructure upgrades
- Allocate resources based on risk
- To provide an efficient means to report essential risk information to the U. S. Department of Homeland Security (DHS).

RAMCAP Modules Completed



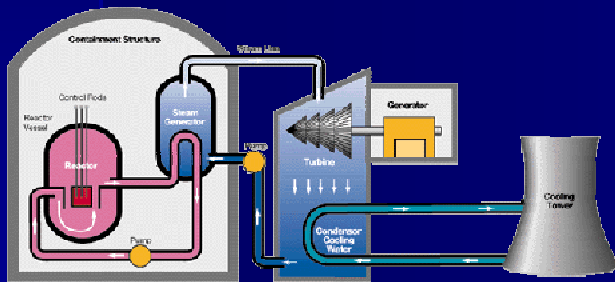
Commercial Nuclear power



Petroleum Refineries



Chemical Manufacturing



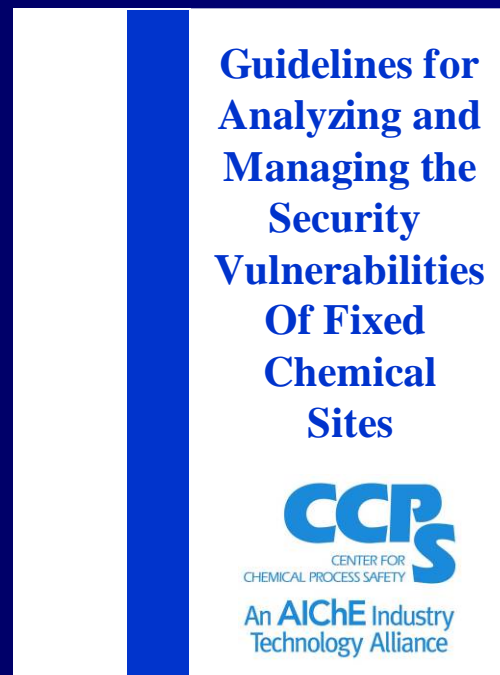
Nuclear Spent Fuel



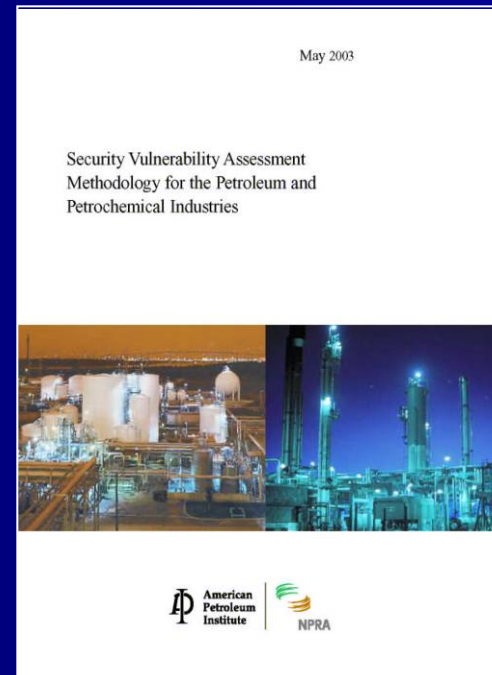
LNG storage

SVA Methodologies

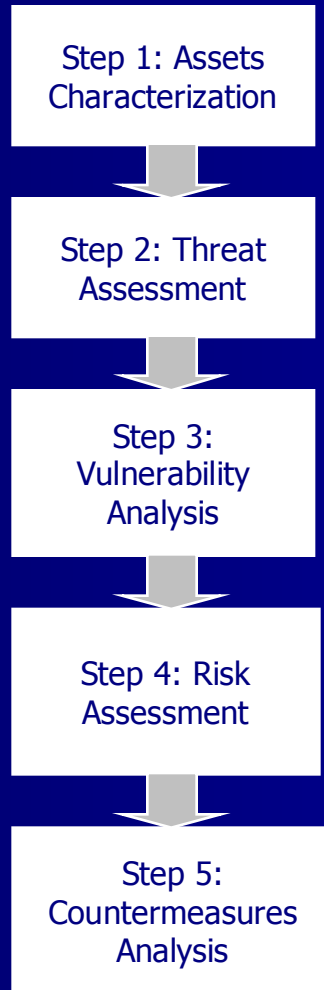
AICHe CCPS



API/NPRA



API SVA Methodology



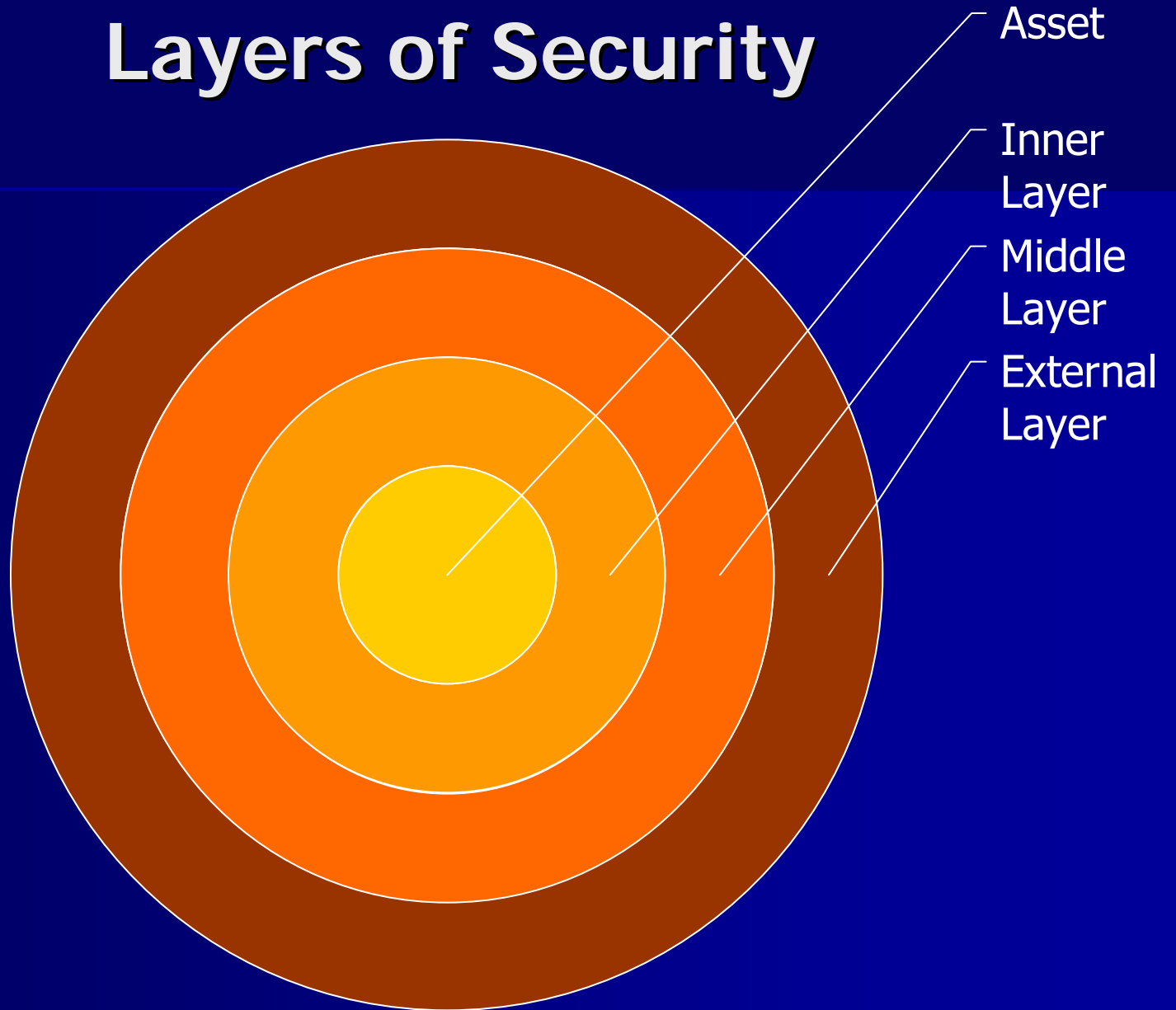
Security Strategies to Manage Risk

Four Basic Strategies

- Deter
- Detect
- Delay
- Respond

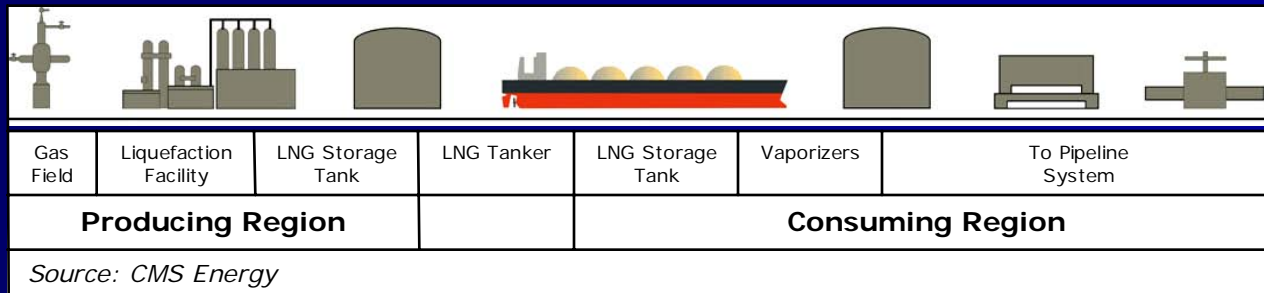


Layers of Security



Value Chain Risks

- Analyze Risks along the value chain
- Compare risks to other industrial risks



U.S. Coast Guard

Role in Liquefied Natural Gas and the Waterway Suitability Assessment



**Homeland
Security**



Existing Mitigation Measures

- Area Maritime Security Plan/Committee
 - MARSEC Level security plan
 - Port Dive Operations Group
 - Minimal Response Actions for Security Incidents
- Facility Security Plan
- Vessels Security Plan (MTSA/ISPS)
- Vessel Security Zones
- Harbor Safety Plan – Navigation Safety
- Vessel Traffic Service
- Regulated Navigation Area

Waterway Suitability Assessment (NVIC 05-05)

Scope of WSA:

- *Address* transportation of LNG from LNG tanker's entrance into U.S. territorial waters, through its transit to/from LNG terminal (receiving) facility, and include operations at vessel/facility interface.
- *Address* navigational safety issues and port security issues.
- *Identify* relevant safety and security issues from broad viewpoint of impact to entire port,
- Provide a detailed review of specific points of concern along LNG tanker's proposed transit route.

WSA Process

- Cooperating Agency with FERC for EIS process
- Letter of Intent
- Waterway Suitability Assessment
- Letter of Recommendation



Navigation and Inspection Circular 05-05



- Cover Page
- Enclosure 1: Timeline
- Enclosure 2: Guidelines
- Enclosure 3: Risk Matrix for LNG (SSI)
- Enclosure 4: WSA Checklist
- Enclosure 5-6: Public Meeting Notice
- Enclosure 7-8: LOR and Record of Decision
- Enclosure 9: Report to FERC (non-SSI)
- Enclosure 10: Report to FERC (SSI)
- Enclosure 11: Sandia Lab Zones of Concern

WSA -Segments

**Section 1:
Traffic
Separation
Scheme**

**Section 2: High
Vessel Traffic**

**Section 3: High
Population
Density**

**Section 4:
Positioning to
Terminal**

**Section 5:
Offloading at
Terminal**

Inbound

Outbound

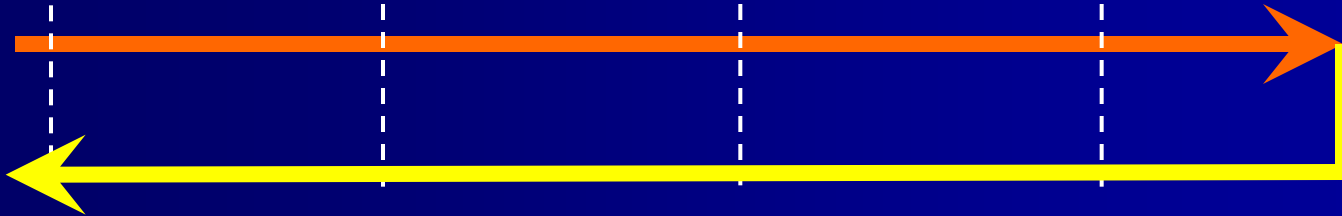
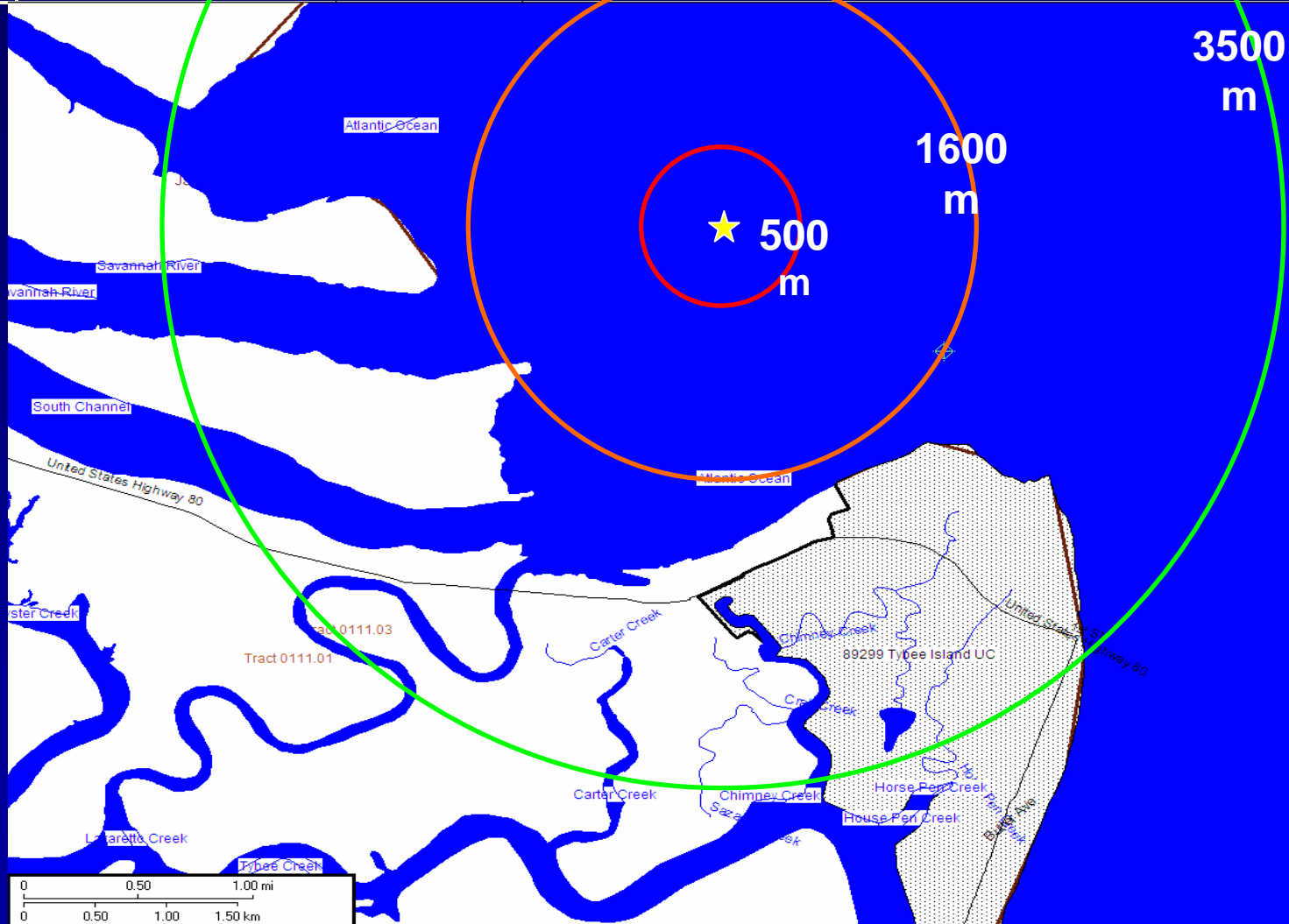


Illustration of Zones of Concern (Intentional Release) (NVIC 05-05, Enclosure 11) (Not to Scale)



Conclusions

- Expectations for security greatly changed post 9/11 and there are significant challenges ahead for HAZMAT
- New risk paradigm requires continual analysis of vulnerabilities and risk management
- Overall strategy for security is a function of business and risk objectives balanced against consequences, vulnerabilities, and threats

QUESTIONS?



Thank You

