<u>Security of Chemicals in a New Era</u>

Preventing the use of industrial chemicals as weapons against the public.

On September 11, 2001, the United States entered a new era. On that day, our long history of security in our homeland came to an abrupt halt. We now face a new reality, one in which we are vulnerable to attack right here in America. We have a fierce and determined enemy, one who is clever and innovative, an enemy with no limits to the savagery of the attacks they are prepared to mount.

Any reasonable assessment of security must now take into account this new reality. We must stipulate in our planning that the foe is ready, willing and able to do the unthinkable. Both the government and the media have been considering the possibility that these terrorists are willing to unleash a weapon of mass destruction on an unprotected population, either here or abroad. Industry must accept that among those weapons of mass destruction available to the enemy are a variety of chemicals and chemical compounds, and in fact, these may be the weapon of choice. In some cases, chemicals are easier to obtain and process into a weapon than either nuclear or biological agents. Accordingly, the challenge to the chemical industry is clear; we must identify those chemicals (and the products from which they can be extracted) that can be used as weapons, or to produce weapons, and protect them accordingly. If we can do this effectively, we will also attain a secondary objective, that is, we will be protecting our manufacturing and distribution infrastructure from an attack aimed at creating economic disruption.

One approach now gaining acceptance in industry is for a company to evaluate the chemicals it produces, processes, uses, buys and/or sells in the United States by asking a series of critical questions about these chemicals, and based upon the answers, develop a list of "Chemicals of Concern" that may be subject to use as weapons. These companies pay careful attention to materials identified as being of concern by several authoritative sources, including The FBI, in its Weapons of Mass Destruction (WMD) Handbook, The Australia Group, The Chemical Weapons Convention and the Bureau of Export Administration.

The list of "Chemicals of Concern" is then further refined by sorting into categories based upon how a given chemical might be subject to use as a weapon. The categories are:

A. Chemicals which, if released to the atmosphere in a sufficient quantity, may cause death to a significant number of people.
B. Chemicals which, if diverted, could be used to produce chemical weapons. This category is further broken down into:
    - B1 - Chemicals which, if diverted on a large scale, could be used to support a state-level (or quasi-state level) chemical weapons manufacturing structure.
    - B2 - Chemicals which, if diverted on a small scale, can be used to produce simple or crude chemical weapons, without the use of sophisticated processing equipment and without producing an obvious manufacturing "footprint".

C. Chemicals which, while in process or in storage, are vulnerable to sabotage or tampering that could produce an uncontrollable reaction or pose a threat to the civil population.
D. Chemicals or other assets which, if not available to the company, will cause an operating interruption with severe downstream economic consequences.

Each category of chemical calls for a slightly different approach to security. By placing specific chemicals into categories, it becomes possible to describe the results of the security effort to be achieved in regards to each category. In addition, the discussion of each category provides insights into the process used in categorizing our chemicals, so as to allow security and operations professionals throughout industry to add those materials that they know to fit the respective criteria, but are not mentioned here.

1. Category "A" Chemicals

Category A chemicals are, in general, inhalation poisons. Examples include chlorine and anhydrous ammonia.

The primary security objective in regards to these chemicals is to protect them against intentional release, especially on a large scale.

These chemicals have several critical properties. In general, they are inhalation poisons of a high order, likely to produce death in humans, even in relatively small concentrations. A significant release of one of these chemicals has a high probability of producing fatalities "beyond the fence line" of the company. They are near the same weight as air, so they tend to "waft", or drift on the wind. A significant release can accumulate and move in lethal concentrations under most "normal" weather conditions. They are usually difficult to control or destroy once a release has begun.

The factors to assess in determining the risk associated with a particular holding of an "A" chemical include:

<u>The quantity stored</u>
Either in a particular vessel or set of vessels, or in a particular situation (such as a warehouse). In general, Category "A" chemicals are at greater risk as the quantity held in a given vessel increases. So, for example, a 5000 lb. tank of an inhalation poison is not necessarily a significant hazard, but a 500,000 lb. tank is almost always a significant risk if it holds such a chemical.

<u>The structure of the vessel walls</u>
Especially its ability to withstand various types of attack. The construction of an "A" chemical vessel will typically include a steel shell, an insulation layer, and an outer shell. If these layers are of an adequate thickness (depending on the material) they may offer a significant degree of protection against attack. For example, the ubiquitous RPG-7 (Russian-made rocket propelled grenade) employs the "Monroe Effect" to penetrate armor, or in this case, the wall of a

storage tank. The "Monroe Effect" is defeated by multi-layer construction, which causes the hot gasses produced by the projectile to dissipate in the interim layer. Therefore, an RPG-7, fired at a vessel with a 2" steel shell, a 4" insulation layer, and a 2" inner steel shell, would likely fail to penetrate. The attacker would have to hit the vessel with 2 RPGs, one after the other, in EXACTLY the same spot, in order to penetrate the inner shell.

The structure of the vessel base

Which also effects the types of attack that might be successful in causing a release. Some vessels are built on platforms, generally concrete. Often, these platforms rise above grade, and are sometimes even built on pilings, and so the vessel is effectively several feet off the ground. Where the platform on which the vessel rests raises it more than ≅ 3' (1 meter) above grade, the probable success of a small car bomb intended to put a hole in the tank begins to drop off dramatically. In addition, a raised vessel is far less vulnerable to a ramming attack than a vessel on or close to grade.

Piping to Alternative Vessels and/or a destruct facility

The ability of operators to quickly empty a vessel that has been breached, either to alternative storage or to destruction, effects the quantity of material which could be released. The presence of such a capability also introduces additional complicating factors for an attacker, and so reduces the attractiveness of that vessel as a target. The ability for operators to quickly close isolation valves, and the volume of piping between isolation valves, is also a consideration. However, it is important to assess the vulnerability of the mitigating infrastructure itself, which may be destroyed in a simultaneous attack.

Dikes and knee walls

Many vessels are constructed with a dike or concrete knee wall in order to mitigate potential releases. The nature of the dike is a consideration in evaluating the vulnerability of a vessel, because the construction of the dike may preclude a ramming attack, and may also force a minimum standoff distance for a truck or car bomb. Variance from grade (of the containment area within the dike) is an additional factor that may preclude close or contact approach by a vehicle. It is important to evaluate each dike, because there are often deficiencies in them from a security point of view. An un-reinforced concrete knee wall, for instance, will not stop a heavy truck moving with some speed. Many earthen or gravel dikes are built with vehicle ramps to permit maintenance or other vehicle access to the containment area, and these ramps can also be used by an attacker. In regards to standoff distance for a truck bomb, both the distance at which such an explosive would be detonated, and the shape of the vessel relative to that point on the ground, are important considerations. The typical "field expedient" explosive (ammonium nitrate and diesel fuel) is a low explosive, that is, it produces a shock wave, which pushes, rather than cuts. In the case of a chemical storage vessel, that may be worse than a high explosive scenario, because a pushing shock wave may well cause complete vessel collapse without causing an ignition of the material contained therein. The Oklahoma City bombing was such a device. Therefore, consider where a vehicle bomb can make its closest approach, and consider the distance to the vessel and the "sail area" of the vessel relative to that point(s) on the ground.

Proximity to the fence

The location and visibility of a vessel within the facility are considerations, and may aggravate or mitigate the vessel's vulnerability, especially to simple attack scenarios (the guy with the high-power rifle). A vessel that is inside a building is significantly less vulnerable to such an attack. A vessel alongside an off-site road is more vulnerable. In the case of smaller vessels, proximity to the fence will also effect the potential off-site consequences of a release. Consider the construction of the vessel relative to the distance to a possible firing point. Remember that a bullet in flight arcs, and so a projectile will not strike a vessel "flat", except at very specific ranges, generally 22 meters and 300 meters. At all other points, the projectile is either rising or falling relative to the target. In most cases, even a very powerful rifle and cartridge combination suffers dramatic loss of velocity (and penetrating power) beyond 300 meters.

Markings

The markings on a vessel, depending on its visibility, may also effect its attractiveness as a target. So, a very large vessel, alongside a road, is more likely to become a target if it says "Chlorine" in six-foot letters.

Population

Where the release of the contents of a vessel or group of vessels will impact a significant population, the value of that vessel increases. This is the "Terrorist Roadmap" the chemical industry was concerned about when resisting the EPA's decision to post RMP data to the internet. In terms of terrorism, an additional layer of consideration must be added. The particular population to be effected is a factor in determining how attractive a target the vessel is. Where the potential population impact is concentrated in a large metropolitan center, with a large media outlet, the value of that vessel as a target increases. From the terrorist point of view, a toxic cloud in New York is much better than a toxic cloud in Topeka.

Profile

Terrorism has, at its core, the objective of spreading fear, and disrupting normal life in the targeted community. For the terrorist, media attention is a key consideration in planning an attack. Another consideration, especially where an attack on private industry is concerned, is whether or not the targeted company has sufficient influence to effect government action, and sufficient public profile to garner heavy media attention. Where the answer to these questions is yes, the company's assets become a better target than the assets of a small, not publicly known company.

Downstream Production, Transportation and other key infrastructure

Where possible, a terrorist will select one target that will have far-reaching and widespread impacts. Therefore, if a given vessel failure will produce both fatalities and other impacts (economic disruption, water contamination, closure of transportation routes. Etc.) the vessel becomes a better target.

2. Category “B” Chemicals

Category B chemicals are, in general, chemical weapons precursors. Most such chemicals can be found in the relevant Schedules of the Chemical Weapons Convention, the Australia Group, and other authoritative sources. This listing divides chemical weapons precursors between those which would involve complex chemistry to weaponize (Category B1), and those which can be weaponized using “bucket” chemistry (Category B2).

<u>B1 Chemicals</u>

These are chemicals which are well-known precursors to industrial-level chemical weapons production. A list of such chemicals would include Mercaptoethanol and Thiodiglycol.

The primary security objective in regards to B1 chemicals is to protect them against systematic diversion, especially on a large scale.

These chemicals have been classified Category “B1” because they have several critical properties. They are chemical weapons precursors for which there are developed and documented chemical processes for the production of weapons of mass destruction, where the resultant product is a known and tested weapon (i.e. Mustard, GB, VX). The chemical processes used to manufacture weapons from these materials are generally complex, requiring a chemical plant and highly trained personnel. The types of weapons produced from these chemicals are generally sophisticated and require very careful storage and handling. Finally, the types of weapons produced from these materials are not easily delivered to a target, or they are difficult to deliver effectively.

The factors assessed in determining the risk associated with a “B1” chemical are primarily “know your customer” issues. The principal security measures that are applied to these materials are those associated with an effective counter-diversion program. Key elements of such a program are:

- Carefully screening all customers for these products, and declining business with those that are not <u>demonstrably</u> legitimate
- Ensuring those entities to whom these chemicals are transferred are not “Denied Parties” or within (or under the control of) a “Denied State Party” as defined by the CWC and/or the Bureau of Export Administration (BXA)
- Handling raw materials so as to minimize the risk of theft or diversion
- Limiting sales volumes to what is reasonable, given intimate knowledge of the industry
- In screening customers, require the following information to be included in the initial purchaser qualification package:
    - Requestor Name
    - Requestor Address
    - Requestor Corporate Affiliations
    - Officer(s) of any involved company

- Material delivery address
- Copy of requestor's Applicable Licenses and Registrations (actual copy, number only is not sufficient)
- Requestor's unambiguous statement of end-use including customers (see below)
- List of products containing Controlled Chemicals, including package configuration(s)
- Label samples (for all products and package configurations relevant)
- Requestor's business references (3)
- Requestor's banking reference
- Statement from in-house sales personnel as to how the customer was acquired and internal knowledge of requestor's place in the market
- Type and amount of material requested
- Terms and conditions of sale and delivery

With this information in hand, the company has the baseline data from which to conduct a reasonable screening of the potential customer, and then:

- Acquire a current Dun & Bradstreet® (or equivalent) report on the company
- Determine if the information provided agrees with the D&B® report
- Determine if the company's size and capitalization is consistent with the proposed business activity
- From in-house sources (or material supplier) determine if the proposed business segment exists, and can absorb proposed volumes.
- Acquire verifying information for all aspects of the qualifying questionnaire through a computer search system such as CBD Infotech®.
- Compare letterhead phone number to CBD® listing, street address data to D&B® data, etc.

In cases where the proposed customer is claiming to toll for a major manufacturer, require a copy of the tolling agreement or disclosure of the contract partner, and then verify the information with the major manufacturer. This same procedure is employed in cases where a major retailer has contracted for generic products. If the proposed customer claims trade secret problems, agree to a secrecy agreement between the customer and your Corporate Security or Corporate Legal Services department.

In cases where the proposed customer is not a company (for example, a college researcher) determine who the senior official of the relative institution or institutional segment is (such as the chairman of the chemistry department at a given university) and call him/her.

Remain vigilant for "Unusual or Suspicious Orders", meaning a transactions involving an extraordinarily high quantity of a chemical, an uncommon method of payment, an unusual method of delivery, etc. Considerations in whether an order is unusual or suspicious include:

- If the order is substantially greater than orders previously received from the customer
- If the order is received more frequently or on a shorter timeline than previous orders

- If the size or frequency of the order is inconsistent with the known nature of the customer's business
- If the customer is offering an unusual method of payment (e.g. cash or any form of payment which can not be audited and linked through documents to a particular payer)
- If the customer is offering to pay a price substantially in excess of the normal market price
- If the customer is requesting delivery to an unknown site, or to a site different than that normally shipped to, or to a location that is not a known manufacturing site for the stated finished product to be produced
- If the customer is requesting other atypical delivery arrangements, such as customer pick-up, immediate delivery, etc.
- If the customer is indicating a novel use for the chemical, or a novel packaging and/or marketing scheme
- If the customer is or is not reasonably conversant on the subjects of chemistry and the chemical business, that is, the customer is aware of the chemical properties of the material he wishes to purchase, is aware of it's typical uses, he knows how to pronounce and spell the name of the chemical, and is aware of regulations and business practices that are normally applied to that chemical, its sale, and its transportation.

All suspicious orders are to be immediately reported to the appropriate authorities.

<u>B2 Chemicals</u>

Category B2 chemicals are also chemical weapons precursors. Like the Category "B1" chemicals above, most of these chemicals can be found in the relevant Schedules of the Chemical Weapons Convention, the Australia Group, on the FBI's list of chemicals of concern, and other authoritative sources. These chemicals have been categorized separately, because they can be weaponized using "bucket" chemistry. Because that is the case, these materials are at greater risk following 9-11 than the typical precursor. These chemicals, if stolen even in small quantities, can theoretically be used by terrorists against our community. Examples of "B2" chemicals are Phosphorous Oxychloride and Phosphorous Pentasulfide.

The primary security objective in regards to B2 chemicals is to protect them against theft, even in small quantities. This includes theft from the point of manufacture, storage, distribution, etc. and includes the diversion of such materials.

These chemicals have been classified Category "B2" because they have several of the following properties:

- They are chemical weapons precursors for which there are developed and documented chemical processes for the production of weapons of mass destruction, where the resultant product is a known and tested weapon (i.e. Mustard)

- The chemical processes used to manufacture weapons from these materials are less complex, and do not necessarily require either a chemical plant or highly trained personnel.
- The types of weapons produced from these chemicals are not sophisticated.
- The types of weapons produced from these materials are not especially difficult to deliver to a target.

The factors which must be assessed in determining the risk associated with a "B2" chemical involve both Business Unit "know your customer" issues as discussed above, and manufacturing/logistics issues regarding physical security.

The principal security measures which are applied to these materials are the Business Organization safeguards against diversion detailed above, and strong anti-theft programs in manufacturing, storage and transportation.

The key elements of a strong anti-theft program are Employee Screening and Staff Supervision.

Small quantities of chemicals are most easily stolen by insiders. Proper employee screening is therefore critical.

Where these CW precursors (useful to a terrorist in small quantities) are concerned, industry must work to ensure that individuals with access to these materials are never "alone". Supervision in this context may include the presence of a co-worker, a supervisor, or in some cases, a closed circuit television monitored by security personnel, when a worker has access to a material.

While in production, access to material should be placed under supervision when:

- Material reaches the point in the process where it has taken on the essential chemical nature of the precursor, and can be sampled
- Material comes off production
- Material is transferred to drum, bullet or tank storage
- Material is being transferred to a transport container, such as a drum, iso-tank or rail car
- Material which has taken on the essential chemical nature of the precursor is removed from production as waste or re-work
- Material is in storage, especially when the storage container is not tamper-evident

It is important to recognize that, with industrial chemicals, material accountability is far less detailed than is the case with a fine chemical. Often, the amount of material needed for the production of weapons can be stolen without fear of the shortage being noticed, and so supervised access becomes the best safeguard against such theft.

Key elements of such a program for material in transport/distribution include:

- Supervised access (see above)
- Sealing of vessels and containers
- Recording and verification of seal numbers

- In-transit monitoring of the carrier, through GPS or a similar system
- Tamper-evident packaging
- Package weighing following refinement of tare and variance tolerance
- Secure warehousing
- Discrete marking
- Use of known and vetted carriers
- Establishing an appropriate police response plan with the local authorities for warehouse and distribution operations
- Use of electronic security systems in storage and distribution facilities, including closed circuit television, intrusion alarms (both automated and "panic" systems) and electronic access control systems
- Establishing the ability to audit access by person and time, most easily done with a card access system

All known or suspected theft/loss of these materials must be immediately reported to the proper authorities.

3. Category "C" Chemicals

Category C chemicals are materials that are susceptible to uncontrollable exothermic reactions, or chemicals which will go into the food, nutrition, cosmetic or pharmaceutical chains. Given the extensive catalogue of chemical products, intermediates and raw materials in use by industry, there are many obvious examples. Insofar as the principal security issue with these materials is high-volume storage and security of the process and finish goods itself, it is sufficient to describe the category and allow manufacturing and transportation personnel to identify those chemicals they use or make which fall into this category.

The primary security objective in regards to these chemicals is to protect them against process and storage tampering/sabotage.

Certain chemicals can be destabilized through the introduction of a catalyst or reactant. Other chemicals can be destabilized by changing ambient conditions such as temperature. Still others can be placed into an uncontrollable reaction by un-balancing mixture ratios or process conditions such as pressure or flow rates. These materials, which can be induced into an uncontrollable exothermic reaction, are at risk for process or bulk storage sabotage. Finally, the full range of chemicals going into human consumption chains are subject to tampering.

Example - stored material sabotage:
There are several reactants which, if introduced into Glacial Acrylic Acid, will cause polymerization to occur much sooner and much more rapidly than would otherwise be the case. This can, under the right conditions, cause a very large explosion. Such reactants are not difficult to acquire; in fact, many common materials will suffice.

Example – process sabotage:
In one common chemical manufacturing process, styrene is combined with water under specific heat and pressure conditions. When styrene is introduced in too great a concentration, the resultant mixture will become uncontrollable. These

are chemicals and chemical processes which are subject to a fairly simple act of sabotage.

Example – Finish goods tampering:
Finish goods destined for human applications, such as pharmaceutical chemicals, can have a contaminant introduced. In most cases, such materials undergo thorough quality control inspections before use. However, where such QC measures are less painstaking, a vulnerability exists.

Key elements of security in these situations include:

- Reevaluation of process safety technology, training and equipment. In most cases, process equipment and the related safety systems are designed to prevent or, if necessary, deal with an accidental unstable condition. In the case of materials such as Glacial Acrylic Acid, a deliberate destabilization could easily involve a much greater volume of material (i.e. 5 tanks at once, as opposed to accident scenarios involving just one or two tanks). Reevaluation of the relevant safety systems may include increasing capacity to quench reactions, dump materials from the process, or other such measures.
- Supervised Access. (see above)
- Physical security over such materials in storage or transport (see above)
- Physical and logical security of the process control system and safety instrumentation
- Strong QC practices for human application materials

4. Category "D" Chemicals/Assets

The chemical industry is unique in the level of vertical integration and site and company interdependence. Many, if not most chemical manufacturing facilities depend upon other chemical plants in order to operate. In some cases, the other plants are owned by the same firm. Often, material supplies arrive via pipeline from a neighboring plant.

Another unusual characteristic of the chemical industry is the volume of raw material and finish goods kept on-site. Those materials brought to the manufacturing site by rail, bulk truck or in small containers are often held in large quantities. Finish goods are often stored in large quantities in anticipation of "busy seasons". When this characteristic is considered in conjunction with the fact that many materials are produced by only one company or plant (or mostly by one company or plant) it becomes apparent that there are points of vulnerability throughout the chemical manufacturing system.

In some cases, these points of vulnerability may be a piece of equipment or a plant. In some cases, the point of vulnerability is a chemical. It would be irresponsible to cite an example of a point of vulnerability in this forum. But to illustrate the issue, take a hypothetical example:

The BIG Chemical Company is the only major manufacturer of chemical X. Chemical X is the principal active ingredient in a broad range of fuel additives, and is found in virtually all finish goods motor fuels. There are substitutes, but none which could be used without making substantial changes to the manufacturing processes. The BIG Chemical Company manufactures and stores Chemical X at a single plant. Therefore, either the loss of the manufacturing capacity or the loss of the on-hand stock of Chemical X would have a devastating impact on the economy, insofar as either loss would cause the cessation of motor fuel manufacture for several weeks.

For Category "D" chemicals and assets, the key security issue is the physical security of the manufacturing and distribution choke point(s).

Physical Security is attained through a combination of infrastructure, security operations and procedural measures.

Infrastructure includes:

- Access Controls
    - Effective access control is the cornerstone of all good security programs. A system is effective it allows management to determine who is on the site at any given time.
- Closed Circuit Television Systems (CCTV)
    - CCTV Systems must be monitored in real-time to be useful in counter-sabotage, counter-terrorism
    - In general, a security officer cannot watch more than 3–5 monitors at once, nor can one officer watch a set of monitors for more than 20 to 30 minutes at a time.
    - Cameras can be "sensitized" so as to produce an alarm whenever a scene (or part of a scene) changes. Doing so will increase the effectiveness of the system, and increase both the time and the number of monitors that can be watched by a security officer.
- Key and Lock Controls
- Sensors
    - Intrusion alarms include heat, motion and pressure sensors as well as traditional contact alarms.
    - An intrusion detection system is only worthwhile if there is a response capability to back it up.
- Physical Barriers and Barricades
    - Fences and walls
    - Crash barriers around key potential targets will prevent the close approach of vehicles
- Lighting
    - Lighting is one of the best preventative measures. A well-lit perimeter is both a strong deterrent and will greatly improve the value of sensors, cameras and security patrolling.

Security Operations includes:

- Security Patrolling
    - In general, security officers are most effective when they are visible and patrolling on a random basis. Patrol officers should always have a completely reliable means of communication. Where possible, officers should patrol in pairs.

- Gate Controls
- System Monitoring
- Coordination with Police
    - Including on-site response training and qualifying police responders in the use of PPE

Procedures include:

- Visitor Controls
- Work Permits
- Employee and Contractor Screening
- Package Control
- Mailroom Controls
- Truck and Railcar inspections
- Safety Regulations
- Emergency Response Training and Equipment

5. Summary

The examples of chemicals in each of the sections above are by no means comprehensive. At this point, less than a year into the "Post- 911 Era", this set of categories represents one best estimate. This discussion of the concerns regarding different types of chemicals, and a suggested approach to security in each case, should enable operations personnel to see their processes and materials in a new light, and use their good judgement in determining if a given material requires greater security today.

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