U.S. Department of Justice
Bureau of Alcohol, Tobacco, Firearms and Explosives
Office of Strategic Intelligence and Information

ATF - United States Bomb Data Center – USBDC 08-23
(U) ASSESSMENT: Use of Natural Gas as a Terrorist Weapon in Apartment Buildings

08/04/2008

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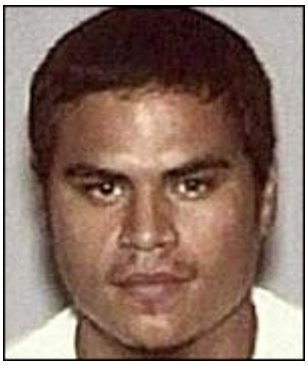
INTRODUCTION

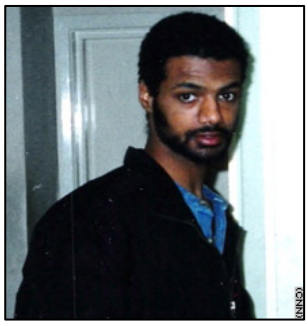
(U) January 2008, Jose Padilla was sentenced to a term of 208 months' incarceration after being convicted in the U.S. District Court for the Southern District of Florida of conspiracy to murder, kidnap and maim individuals in a foreign country, conspiracy to provide material support to terrorists, and providing material support to terrorists. Padilla first came to light May 2002, when he was arrested as a material witness subsequent to his arrival at Chicago's O'Hare International Airport carrying over $10,000 in U.S. currency and a number of other incriminating items.

(U) At a June 2004 press conference, then Deputy Attorney General James Comey outlined the case against Jose Padilla, the so-called "dirty bomber" suspect, and his connections to al-Qaeda.[1] Jose Padilla gained notoriety for the alleged plan to use a radiological dispersal device (RDD). However Padilla's plot to utilize natural gas to blow up apartment buildings in the United States did not seem to draw as much attention as the plan to utilize a RDD. There has been very little discussion pertaining to his plot to cause a catastrophic fire/explosion event at apartment buildings using natural gas.



Jose Padilla

(U) On or about December 2005, Binyam Ahmed Muhammad was charged by the U.S. Military Commission, Naval Station Guantanamo Bay, Cuba with conspiring with Jose Padilla and others.[2] Muhammad, an Ethiopian national who immigrated to the United Kingdom as a teen, was arrested on or about April 10, 2002 at the Karachi, Pakistan airport while attempting to get to London using a forged passport.



Binyam Ahmed Muhammad

(CUI) The information contained herein was gathered from open sources and is believed to be accurate. The methodology illustrated

[1] Deputy Attorney General James Comey, Speech regarding Jose Padilla, June 1, 2004, http://www.usdoj.gov/dag/speech/2004/dag6104.htm
[2] United States v. Binyam Ahmed Muhammad, Military Commission Case No. 05-0009

below is hypothetical. The Bureau of Alcohol, Tobacco, Firearms, and Explosives is not in possession of any information to suggest that Jose Padilla, or any other individual(s) were intending to deploy this specific methodology.

BACKGROUND

(U) Padilla, a U.S. citizen and former street gang member, formally converted to Islam in 1994 at the al-Imam mosque in Florida.[3] He eventually found his way to Afghanistan in 2000. While there, Padilla underwent basic terrorist training at the al-Qaeda training camp, al-Farouq. His training included instruction in the use of firearms, topography, communication, camouflage, clandestine surveillance and explosives as well as other al-Qaeda tradecraft.

(U) In 2001 at the urging of his al-Qaeda mentor, Padilla and Muhammad agreed to undertake terrorist missions in the United States to blow up apartment buildings utilizing natural gas. He, along with Muhammad, received advanced explosives related training with instruction on electrical circuits, switches and timers, as well as how to seal an apartment filled with natural gas in such a way as to provide a maximum yield.[4] [5]

(CUI) Padilla and Muhammad discussed with Abu Zubaida[6], a key al-Qaeda recruiter and operational planner with an idea of detonating a radiologic device in the United States as well as a number of other plots. Abu Zubaida believed the use of a radiologic dispersal device (RDD), also referred to as a dirty bomb, would be more feasible and encouraged Padilla and his accomplice to pursue this operation.

(CUI) The dirty bomb project was passed on to al-Qaeda's top operations official, Khalid Sheikh Mohammed (KSM), who in turn told Padilla and Muhammad to enter the United States and locate high-rise apartment buildings with natural gas, as was originally planned. KSM wanted several apartment buildings attacked simultaneously.

Khalid Sheikh Mohammed

(CUI) They would rent two apartments within each building, seal the apartments, turn on the gas and set timers to function and simultaneously destroy multiple apartment

[3] Amanda Ripley, "The Case of the Dirty Bomber", TIME.com, June 16, 2002, http://www.time.com/time/nation/article/0,8599,262917,00.html
[4] Comey, Speech, June 1, 2004
[5] United States v. Binyam Ahmed Muhammad, Military Commission Case No. 05-0009
[6] FBI, Unclassified Intelligence Assessment, Al-Qa'ida, April 15, 2004

buildings at a specified time. The target city was New York, with discussions of attacking apartment buildings in Washington, DC and Florida. Padilla was given discretion in choosing the apartments to be targeted.[7]

ANALYSIS OF THE APARTMENT EXPLOSION PLOT

(CUI) An apartment building is an extremely soft target, often with little to no security measures in place. There would be a high probability of casualties, which by design would strike fear into the American people by bringing the fight to the very homes they live in.

(CUI) The idea of targeting apartment building is not a new one. A series of four apartment building bombings during a 12-day period killed approximately 300 people in Russia.[8] However, these bombings were accomplished with either vehicle-borne improvised explosive devices or explosive devices placed inside the building.

(CUI) Padilla's plot leaves many unanswered technical questions. To be considered: how to adequately seal the apartments; cause a natural gas flow at an appointed time; and use a time-delay device to initiate an ignition source to achieve the desired effects.

(CUI) If the idea of the plot is to cause death and destruction on the same scale as had occurred in Russia, then Padilla's methodology comes into question. The probability of causing this magnitude of death and destruction using natural gas would be considerably lower. This is not to say that this would be impossible, but there are a number of events that would have to occur to achieve a similar effect.

(CUI) The primary question is how to time the ignition when the optimal fuel-air mixture has been reached to cause maximum effect. To accomplish this Padilla would have to have a working knowledge of natural gas, fuel delivery systems, gas fired appliances and electronics.

[7] Comey, Speech, June 1, 2004
[8] IntelCenter, al-Qaeda Tactics/Target Brief v1.0, Tempest Publishing, May 25, 2002 p22

(CUI) On the surface, the idea is simplistic, if not amateurish. Seal an apartment, create a natural gas flow, and connect a timer to an ignition source. However, the probability of an efficient fuel-air explosion is low. If the timer functions too early in this sequence, the probability of igniting the gas is greatly reduced, as the fuel-air mixture will be too lean. The same results could occur if the timer functions late in the ignition sequence, as the fuel-air mixture will be too rich.

TECHNICAL CONSIDERATIONS

(U) Natural gas is a mixture of gases, and its composition will vary. However, it consists principally of methane, but also contains ethane and small amounts of propane, butane and higher hydrocarbons.[10]

(U) The lower explosive limit (LEL) of methane, the primary component of natural gas is approximately 5 percent, while the upper explosive limit (UEL) is approximately 15 percent. The stoichiometric ratio that would produce the maximum explosive yield would theoretically occur at approximately 10 percent saturation within any given confined compartment. The stoichiometric ratio can be defined as the fuel-air ratio wherein all of the available oxygen in the air reacts with all of the available fuel. At fuel-air ratios above the stoichiometric ratio, more fuel than oxygen is available.

Typical Natural Gas Composition[9]

Component	Typical Analysis (mole %)	Range (mole %)
Methane	94.9	87.0 - 96.0
Ethane	2.5	1.8 - 5.1
Propane	0.2	0.1 - 1.5
iso - Butane	0.03	0.01 - 0.3
normal - Butane	0.03	0.01 - 0.3
iso - Pentane	0.01	trace - 0.14
normal - Pentane	0.01	trace - 0.04
Hexanes plus	0.01	trace - 0.06
Nitrogen	1.6	1.3 - 5.6
Carbon Dioxide	0.7	0.1 - 1.0
Oxygen	0.02	0.01 - 0.1
Hydrogen	trace	trace - 0.02

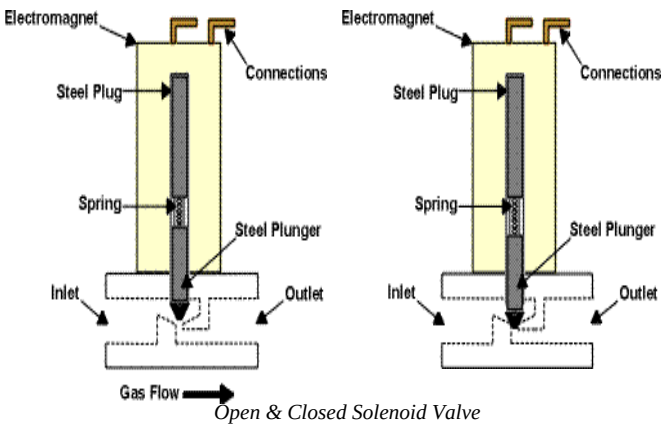
(U) If gas concentrations are reaching the UEL when ignition takes place there will be incomplete combustion of the fuel. The force resulting from any explosion will be greatly reduced because complete combustion cannot be sustained due to insufficient oxygen, resulting in increased fire damage and minimal explosion damage. In contrast, during an incident where the gas concentration is near the LEL there is insufficient fuel which is consumed during the event, resulting in limited fire and explosion damage.

[9] http://www.uniongas.com/aboutus/aboutng/composition.asp
[10] Theodore C. Lemoff, P.E., National Fuel Gas Code Handbook, 5th ed., 2002, p.3

(U) The specific gravity of natural gas (in its gaseous state) is usually between 0.61 and 0.69. Thus, it is lighter than air. The buoyant nature of natural gas tends to form layers near the ceiling. *"The formation of a layer inhibits the mixing of gas with the total volume of air in a chamber or room, and can radically affect the time taken for an explosive mixture concentration to be reached following a leak of gas."*[11] Within any given compartment the location of the flowing gas, its relative velocity, ventilation, and any barriers or occlusions will inhibit the ability of the natural gas to mix with air to achieve the desired explosive concentration.

(CUI) To arbitrarily let gas flow into a sealed compartment, and then rely on a timer to trigger an ignition source with the intent to cause a massive explosion is dubious, at best. On the other hand causing the natural gas to flow at a specific date and time would require some effort and forethought. The pilot light to the gas-fired appliance would have to be extinguished, or in those appliances where there is an electronic ignition system, disabled. The gas line to the burner may or may not be connected.

(CUI) Conceivably this could be accomplished by simply utilizing the existing automatic gas valve or solenoid valve on a gas appliance, which is an automatic or semi-automatic device consisting of a valve and an operator that controls the gas supply to the burner during operation of the appliance.[12] Electricity activates this valve. When electric current is applied to the solenoid valve, it will cause the valve stem to open, allowing the gas to flow. When the current is removed, the valve stem closes, cutting off the gas flow.



Open & Closed Solenoid Valve

(CUI) Bypassing the appliance thermostat and wiring in a timing device, or other remote control switch, would not be practical. Modern gas-fired appliances utilize built in fail-safe or safety shut-off devices to interrupt the fuel flow whenever a pilot outage or other improper operation occurs. Essentially the solenoid valve would not open and the gas would fail to flow.[13] The work around solution would disconnect the gas line upstream from the gas-fired appliance, and then a

[11] R.J. Harris, Ph.D., The Investigation & Control of Gas Explosions in Buildings and Heating Plants, E&FN Spon, London 1983, p5
[12] National Fire Codes, National Fuel Gas Code, National Fire Protection Association, 2006 Edition, p.16, section 3.3.103.2
[13] Joseph E. Bertoni, The Essentials of Gas and Oil Fired Forced Warm Air Furnaces, Fire & Arson Investigator, International Association of Arson Investigators, Inc., December 1996, p.15-18

simple solenoid valve with no fail-safes or safety shut-off device could be affixed to the exposed end of the piping and wired in directly to the timer and a power source. This would completely circumvent the existing automatic gas valve with the built in fail-safe mechanism of the particular appliance. At the appointed time, either by remote control or time-delay, the solenoid would power-up, the value stem would open, and the gas would begin to flow.

(CUI) Sealing the apartment would most likely be accomplished with the use of an adhesive tape, such as duct tape, and plastic to seal off doors, windows and vents. However, manufacturers mix natural gas with ethal-mercaptan or thiopane, an odorant specifically for the purposes of detection. No matter how tight the apartment was sealed, there is a probability of the gas being detected prior to any explosion.

(CUI) Barring premature detection of the natural gas, igniting the buildup while it is between the LEL and UEL and near the stoichiometric ratio, is problematic. It is known that the severity of confined fuel-air explosions peaks close to, but slightly above, the stoichiometric condition, in this case approximately10 percent saturation. Nonetheless, an explosion could occur anywhere within the lower and upper explosive range, as previously indicated.

(CUI) One feasible method of igniting the natural gas would use a portable gas detector set to alert within the specified saturation range. The alarm function of the gas detector could be bypassed and the ignition source wired in. The ignition source could be any spark or flame-producing item, something as simple as a broken light bulb with and exposed filament, or something more complex such as a either a commercial or homemade detonator. When the concentration of natural gas reached the desired percentage, the gas detector alarm would function causing ignition, creating the explosion.

COMMENTS

(CUI) Natural gas does not have the explosive force as has been seen in other major bombings of large buildings where high explosives were used, such as the Oklahoma City Murrah Federal Building in 1995. Because of the deflagrating characteristics of natural gas, the shattering and fragmentation of material typically seen in a detonation will not occur. The structure will tend to give-way at its weakest points. Characteristically in this type of explosion, there will be a significant pushing and shoving reaction propagating at subsonic speeds.

It is possible to have a fuel-air detonation, or progress from a deflagration to a detonation, but this is extremely rare. It can occur under ideal conditions, but requires a powerful energy source and stoichiometeric ratios.[14]

(CUI) Natural gas explosions can be devastating in a single-family dwelling, and even some garden style apartments, that incorporate wood-frame or ordinary construction. However, modern high-rise apartment buildings, tend to be constructed with reinforced concrete and steel, thus the probability of a causing a catastrophic event to the point of a major structural collapse would be greatly reduced.

(CUI) This is not to say a collapse could not occur in such a structure. If there were a significant shift in the load and/or a bearing wall or structural support did not hold as the result of the explosion, there could be a progressive collapse. May 16, 1968, a natural gas explosion at the Ronan Point Flats apartments occurred in a kitchen located on one of the four corners of a 23-story pre-cast building. The explosion caused a progressive collapse of all the corner units above and below the apartment of origin.[15]

Ronan Point Flats

(CUI) In a modern reinforced concrete and steel high-rise, one would expect to see significant damage to interior walls, other non-bearing structures and finishes. Substantial displacement of brick and mortar could also occur. There may or may not be any significant ensuing fire and deep seated burning, based on the fire-load within the originating compartment. Often there will only be some heat blistering and scorching throughout the confined space as well as some localized burning of light combustibles.

(CUI) Any investigation into a gas explosion needs to be thoroughly scrutinized. Not only should the ignition source be determined, but it is also imperative that the nature and circumstance of the leak be determined. Telltale signs of tampering and/or sabotage should be apparent. There may be evidence of manipulation of the suspect gas appliance and/or gas line, as well as attempts to seal the confined space. There also may be evidence of ignition source components, such as wire and perhaps a light bulb filament. Any number of timing devices could be utilized, to include digital watches or even telecommunications technology.

[14] Theodore J. Heitzler, Basic Dynamics and the Investigation of Confined Air/Fuel Explosions, Research Paper, Bureau of Alcohol, Tobacco, Firearms and Explosives, p. 21
[15] http://www.waltersforensic.com/articles/civil_engineering/vol5-no2.htm

(CUI) A number of factors would have to come into play to intentionally cause a natural gas explosion, as the Jose Padilla plot suggest. One of the most decisive factors is the construction characteristics of the structure itself. We should not underestimate the aptitude and capability of al-Qaeda or other terrorist organizations. They have repeatedly demonstrated their ability to plan and execute well-coordinated attacks.