

Non-Lethal Technology (NLT) Approaches to Hostage Situations

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- The opinions expressed in this paper are those of the author and should not be interpreted as an official position of any part of the North Atlantic Treaty Organization or the German Department of Defence, or Government.
- The sources used in this paper are to be found in the original presentation at RTO-TR-HFM-073: The Final Report of NATO RTO HFM-073, www.rta.nato.int.

1. Slide

1. The **wide spectrum of techniques** that may be used and the **variety of situations** make it very difficult to predict all possible **medical effects** of Non-Lethal Technologies. It seems fair to assume, that medical effects of NLW in general, must be mild compared to the lethal alternatives.

2. Slide NLT “magic powder” etc

Quote: „I’d like to have a **magic powder** to take everybody down to sleep immediately“ unquote, US Marines Colonel George Fenton several years ago designed his vision of a new kind of weapon. A peaceful, non-lethal vision, which applies to words like “microscopic operations” and “surgical bombing” in modern US-warfare. There has been at least one situation, where the use of that “magic powder” remained the only way to think of to solve a dangerous assault. I would like to demonstrate value and risks of “chemical” NLT on the Moscow theatre hostage situation.

3. Slide Title on Barajew-background

2. Medical Aspects of the Moscow Hostage Taking 2.1 The Hostage Taking

In Moscow - five years ago – 23. October 2002, in the „North-East“-musical theatre more than 900 people were taken captive by some 50 Chechen fighters for the freedom of their country. Suited in camouflage, equipped with firearms, the rebels had entered the theatre, and proceeded to the stage shouting: “We are Chechens, we are at war here!” They called themselves the “29. Suicide Division”.

4. Slide Female Rebel with strapped on explosives

All but the commander wore black masks, had handguns, and large quantities of explosives around their waists. Thirty-two men and eighteen women hurried to deposit about thirty packages of explosives at the pillars and in the theatre. The rebels threatened to kill everyone inside the theatre unless Russia ended the war in Chechnya.

The next day Al Dshasira broadcasted a typical “confessor video” of the hostage takers, which gave President Putin the possibility, to declare them “international terrorists”. Since that time the rules of “war

against international terrorism” applied.

U.S. President George W. Bush, telephoned President Vladimir Putin and offered firm support during the hostage crisis. On that same day, representatives of the U.S. Special Services met with a deputy director of the FSB to discuss the situation. At 10:40 p.m. that same evening, "the head of the MVD of Russia, Boris Gryzlov, and the director of the FBI, Robert Muller, agreed to work together under a regime of constant communication. Muller proposed to send American specialists on antiterrorist activity and specialists in the sphere of using special technical means".

(FSB (Federalnaya Sluzhba Bezopasnosti) The Russian Secret Service, successor organisation of KGB.

MVD (Ministerstwo Wnutrennich Del) The Russian Ministry of the Interior, 1946 drawn from the NKVD. Since 1954 part of KGB.)

On the third day, just after 5:30 a.m., the audience first noticed the strange smell inside the theatre. Most of the hostages and many of the Chechen terrorists holding them captive, were sprawled across an auditorium seat trying to get some sleep. Alarmed by the odour, gas was spotted, eerily visible as it seeped through the air-conditioning vents and rose from the floor. A hostage later gave evidence that she saw “a terrorist sitting on the stage jumping up and trying to put on an NBC mask. He cramped, fainted and went down”. Then she noticed that everybody around her relaxed and started snoring. An unidentified anaesthetic “gas” was used and the hostage takers inside the hall were unable to act or to ignite their explosives.

One hour later, at 6:23 a.m., uniformed special forces stormed the theatre without wearing NBC masks. In the newspapers and media different groups were named: ALPHA Antiterrorist Specialists, Russian Special Police Units and Spetsnaz-Soldiers. Within 7 minutes they had gunned down the firing terrorists in the corridors and the balconies, who were still awake.

5. Slide Executed Rebel

Then they entered the hall and **executed the anaesthetised terrorists**. Three were arrested. About thirty explosives in the hall had to be localised and deactivated.

6. Slide The Bomb in row 15

Later it was stated that the terrorists had brought in over two tons of various explosives. But **the building** was saved!

2.2 Hostage Rescue and Primary Medical Care

The hostages had been held in a three day martyrrium in continuous fear for their life, without food and beverages.

7. Slide Hostages at the Entrance - wet pavement

A few hostages were able to stumble out of the building on their own, but most had to be assisted by soldiers and emergency workers. Unconscious hostages were carried unprofessionally by their hands and feet or like pigs halves over the shoulders or laying on litters on their backs. No resuscitation or intubation were sighted.

8. Slide Hostages at the Entrance - Bodies

Many unconscious hostages were deposited without any assistance on the pavement in front of the theatre in the cold and rain, bodies one over another.

9. Slide Hostages at the Entrance - more Bodies

Doctors and medics arriving at the scene were not told that the hostages had been gassed and were not provided with the antidote that should have been injected immediately.

10. Slide Bus

Microbuses, buses, ambulances, or cars available were brought in. Once loaded, some busses remained in place for over an hour before leaving for medical facilities.

11. Slide Waiting in the yellow Bus

No patients assistance was provided during this time.

12. Slide Bus and Hands in the Pockets

In one case, thirty hostages were put in a twelve-seat military microbus, and a 13 year-old girl was crushed under other bodies in the aisle and died en route.

Patients were carried to 8 different hospitals across the Russian capital. Some 450 were said to have been treated.

The nature of the rescue effort suggested that the storm was undertaken to destroy the terrorists for political reasons, and that saving the lives of the hostages had a very low priority. Although the Moscow health authorities had days to prepare for the aftermath of the rescue, over one hundred persons who died probably could have been saved if the rescue effort had been properly organized. Primary care, restoring respiration, ventilation, resuscitation, infusions, administration of antidotes, transportation, and intensive care seem to have been excluded from operational planning. Immediate artificial ventilation could have reduced the level of inhaled anaesthetic. The traditional casualty categories could have been used easily, although they always have to be adapted to the actual scenario. In Moscow it became evident to the public that no proper rescue chain was organized. Lots of space in the corridors and lobbies were available in the theatre to put casualties one by one for therapy by individual rescue teams. But, remember the explosives!

Russian authorities have declined to identify the substance used in the theatre. Eyewitness-Reports and the suggestions of experts provided some clue of the nature of the gas.

3. What Kind of Incapacitant Was Used in the Moscow Theatre Incident?**13. Slide Agents**

The whole range of “incapacitants”, “sleeping gas”, products of Cold War times like “BZ” up to “nerve agents” was suspected. So some of the physicians in Moscow hospitals administered the common antidotes as used in the Soviet Army.

One week after the hostage taking the Russian Minister of Health, Juri Schewtschenko, released: "To neutralize and overcome the terrorists a mixture of Fentanyl derivatives was used. The gas was a commonly worldwide used anaesthetic substance and cannot by itself be called lethal". One source close to the Kremlin said the amount of sleeping agent used was five times the normal dose.

3.1 Discussion of Possible Substances Used in the Moscow Theatre

3.1.1 Fentanyl

Fentanyl is a synthetic Opioid. Its analgesic potential is 80 times that of Morphine. Time of Respiratory depression is shorter than by Morphine. Following intravenous administration of fentanyl, the onset of action is within one circulation time. The duration of action is approximately 30 minutes. Fentanyl normally is always applied intravenously (i.v.). High doses induce respiratory depression and respiratory arrest. That is why controlled artificial ventilation has to be prepared and ready for use when working with Fentanyl.

The narcotising effects of morphine derivatives can be antagonized by titration with naloxone (Narcan and Naltrexone). Given the high lipophilicity of fentanyl derivatives, redistribution from tissue stores to the central compartment may explain the recurrent opioid effect. Those effects may be potentiated by acidosis, hypothermia, and rewarming. So patients have to be monitored closely for some time following anaesthesia with fentanyl.

3.1.2 Nitrous Oxide (N₂O)

Nitrous oxide is a colourless gas without odour or taste. It is marketed in steel cylinders as a colourless liquid under pressure. Nitrous oxide is heavier than air. It is widely used as an adjuvant during most procedures in which general anaesthesia is employed. Some patients lose consciousness when breathing 30 % nitrous oxide, and most will become unconscious with 80 %. There is very rapid onset of and recovery from effects. Nitrous oxide frequently is used as a carrier for potent anaesthetics like halothane.

3.1.3 Halothane

Halothane (Fluothane) is a clear liquid, its odour similar to Chloroform. In combination with nitrous oxide, halothane dose can be reduced compared to Halothane only. It's a very potent anaesthetic but with only a low therapeutic index. When overdosed cardiac and respiratory arrest will occur simultaneously.

3.2 Fentanyl Derivates

14. Slide Table

Literature research reveals results from pharmaceutical developments of fentanyl derivatives.

Sufentanil is 10 x more potent than fentanyl, and is available as a nasal spray. Its lipid solubility is much greater than fentanyl or morphine. In adequate doses it produces profound analgesia and narcosis. The stability of cardiac action is impressive.

Trimethylfentanyl, ("3-MF"), 10 – 20 x compared in potency, could have been used, because it is the most frequently traded drug on the black market in the GUS since 1992.

In Table 1 the Characteristics of opioids including fentanyl derivatives *** are displayed.

	Opioid Potency (Compared With Morphine)	Lipid Solubility*	Therapeutic Index**
Morphine	1	1,4	70
Meperidine	0.5	40	5
Methadone	4	120	12
Fentanyl	300	800	300
Sufentanil "Dosette"	4500	1800	25000
Alfentanil	75	150	1100
Remifentanil	220	18	33000
Carfentanil "Wildnil"	10000		10600

*) Lipid solubility = octanol/water distribution coefficient.

**) Therapeutic index = median lethal dose (LD50) / lowest median effective dose (ED50).

***) **These animal numbers from 1976 may not easily extrapolate to humans!** Modified from WAX, Paul M., BECKER, Charles E. and Steven C. CURRY, MDs: Annals of Emergency Medicine, May 2003 Volume 41 Number 5, 700-705

Carfentanil is again 30 to 80 to 100 times as potent as fentanyl and has a therapeutic index 30 times higher, which means that narcotic activity will start at once with only a drop of the substance near a human, and that it is very well tolerated as long as the airways are kept open and adequate amounts of oxygen are in the breathing gas.

15. Slide Parameters

4. Technical Parameters

The ideal effective agent would be characterised by its

1. Dynamic Parameters:

- time of onset of effect > immediate,
- duration of effect > sufficient for the operation required,
- recovery time > as soon as possible,
- reversibility > total.

2. Therapeutic Index (ratio of lethal dose to effective dose LD_{50}/ED_{50}) > very broad,

3. Physical Parameters > easy to store, easy to handle, liquid or gas as required, and

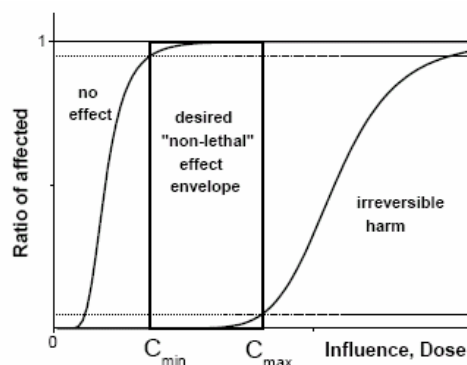
4. Sensory Quality > invisible, inodorous, tasteless, neutral in temperature.

The effective incapacitant agent had to be injected into the large hall of the musical theatre via the ventilation system as a gas or aerosolised in case it is delivered as a liquid. This process had to be noiseless, invisible, and very fast, but without changing the preset ventilation flow rate. To fill the volume of the musical hall with an adequate concentration of the incapacitant per person, in a rough estimate 19.5 kg of fentanyl were needed, for Sufentanil about 1.3 kg and for Carfentanil 0.65 kg.

16. Slide Figure Curves

The **figure** demonstrates the effect of a non-lethal agent on human organisms according to medical concept. The first curve shows the dependence of the probability of the desired effect of a NLW on the human population depending on the strength of impact, in this case „dose“. When the dose increases, undesired consequences including fatalities will appear.

The second curve shows this dependence. Typically the acceptable interval of impact strength include the concentration interval from 95...97 % persons under required influence to 3...5 % of those who receive undesired damage or death. Minimal and maximal dose of this "desired operating envelope" differs no more than 2 - 3 times.



At the first glance it looks simple to calculate the necessary dose and apply the required amount of NL calmative somewhere in the middle of this envelope to guarantee success of operation when terrorists are knocked out of action and hostages remain safely.

Therefore the local concentration of agent easily can be changed in the interval of 1.5 to 2 times around mean value. But on the other hand, “accumulated dose” means the product of concentration and time of contact!

This time has great scattering too, from 10 min necessary for the fighting operation in a big defended building to 30 min necessary to fulfil hostage evacuation from the influenced area and for first medical aid. Therefore this factor gives the second coefficient of dose scattering. So overall dose scattering can reach values of 3 to 4 of the average dose value. In this case the "desired operating envelope" simply disappears. If the level of 95 % efficiency is absolutely required to neutralize terrorists and to prevent total mass destruction, there is no chance to eliminate severe consequences and fatalities. Calculations show that the majority of hostages will suffer from serious poisoning and part of them fatality. This is the cost of retribution to pay if no other solutions are left.

5. Outcome, Value and Risks of the Incapacitant Used

129 (16 %) of the 800 hostages in the theatre died, and more than 650 of the survivors required hospitalisation. It is expected that several of the surviving hostages have suffered from hypoxic lesions and brain damage. Some possible reasons for the deviation from the theoretical approach might be offered:

To be effective in the large hall the concentration of the incapacitant had to be very high.

Hostages were exposed to different concentrations at different places.

The different weight of the aerosol compounds towards air might have provoked different concentrations of different substances at different places.

Large volumes of the aerosol might have pushed away the breathing air. Low oxygen concentration might have resulted in asphyxia.

The hostages differed with respect to age, sex, weight, body mass index, state of general health, fatigue, dehydration, and panic or fatalism, which influences the respiratory rate.

An easy and most probable rationale of the deaths is that the hostages fainted in their seats to profound unconsciousness. In consequence, their airways were blocked and hypoxia developed with irreversible brain damage after about 3 - 6 minutes. From blowing aerosol into the hall to the beginning of the liberation action 60 minutes elapsed. Even if the anaesthetic activity had been very short, the effects of hypoxia are sufficient for the deadly exit.

The need to find and neutralize the widely spread ordnance may have been the reason for the delay of the rescue of the hostages. There was no medical assistance seen being given to the hostages, no stabilised resting position, no artificial ventilation, and no infusions. Availability of antidotes was not sufficient. From the official side there were claims that not enough physicians were available to administer the antidotes. But in fact any helper could have injected naloxone into the muscles.

17. Slide North-East Theatre – the Work is done

6. Conclusion from the Analysis of the Moscow Theatre Incident

More than 800 people were taken hostage and were about to be killed. Given the large number of explosives in the hands of the terrorists, a conventional assault or the use of more toxic chemical agents would probably have significantly increased the number of casualties in a destroyed theatre. To rescue them, the Russian authorities inserted an “incapacitant agent” in an attempt to subdue the rebels. Although it may seem excessive that 16% of the 800 hostages died from or after the “gas” exposure, **84% survived**. We do not know that a different tactic would have provided a better outcome. The use of an “incapacitant” in this setting was a novel courageous attempt at saving the most lives. This counter terrorist action showed that chemical “non-lethal” weapons are not always non-lethal, because the dosage for the individual can not be limited safe enough or monitored over the time. The variability of the situation (e.g., where one was located within the theatre) combined with the variable sensitivity of the population of individuals in the theatre (e.g., age, body size, state of arousal, breathing frequency), combined with the disastrous consequences of organisational failure, created a situation where non-lethality could not be guaranteed.

The planning and execution of medical attention to the hostages seems to have been scanty. The tragic outcome due to dilatory preparation of the rescue activities and therapeutic strategy shows how important **tactical medical planning** is in an overall operative environment.

APPENDIX

18. Slide Handling of a Mass Casualty Situation

In a Mass Casualty Scenario Triage and actual stating the Priority of Treatment on site is fundamental and has to be carried out by the most experienced physician on site. A mass casualty situation may be defined as a situation in which the number of casualties presenting cannot be managed by normal methods and facilities. So medical triage is to ensure that “as many patients as possible will get the treatment as needed in time at the right place”. The agreed NATO categorisation of casualties is (according to STANAG

2879):

Group 1: Immediate Treatment

Acute emergency life saving therapy: overcome respiratory obstruction, ventilate, restore heart action, give i.v. infusions, put into stabilized resting position.

Group 2: Delayed Treatment

Special treatment necessary (for example: time-consuming major surgery) to include those badly in need of, but whose general condition permits delay in surgical treatment without unduly endangering life. Stabilize respiration and heart action, stop haemorrhage, administer i.v. fluids, pain relief, splinting and others. Transportation to adequate treatment facility.

Group 3: Minimal Treatment

To include those with relatively minor injuries who can effectively care for themselves or who can be helped by untrained personnel. Carry to waiting area, calm down.

Proper preparations for the rescue had to be done according to the preview of the possible scenarios within the tactical planning. Preparation of medical trained rescuers and medical teams with suitable stores of effective antidotes would have been essential. The Medical Services of the Forces and their logisticians, may be also a Non Governmental Organisation (NGO), could have organised the necessary medical facilities nearby the theatre. Hundreds of physicians and qualified medical assistants, and their material had to be brought in. In case of a success of the knockout operation they could have been rushed into the theatre for first aid and resuscitation, at least two per person in the auditorium.

In case of explosions and damage to the theatre transportation lines had to be cleared. Special search and rescue teams with trained dogs and electronic devices should have been in close vicinity. Mobile intensive care facilities should have been arranged nearby in a protected area with hundreds of places prepared for qualified antidote therapy, resuscitation and first surgical treatment.

Facing an emergency situation involving more than 800 persons would have needed a much more intensive preplanning.

19. Slide Background Rules of Law

Finally, after having held this résumé,

1. I present the legal background for discussion later on and
2. I would like to express my strong feelings of sympathy with the people who were taken hostages in the theatre and the dependants and relatives of the victims.

I would like **you all** to stand up and remain quiet for a moment of remembrance.

I thank you all!

Background: Rules of Law

- **1925 Geneva Protocol** (Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare)
- **1948 Geneva Conventions**
- **1977 Additional Protocol I**
- **1991 Chemical Weapons Convention**
- **Internal and International Law**
- **National Criminal Law**
- **Law of Armed Conflict**
- **??? Standards of Law applicable to the War against Terrorism ???**

