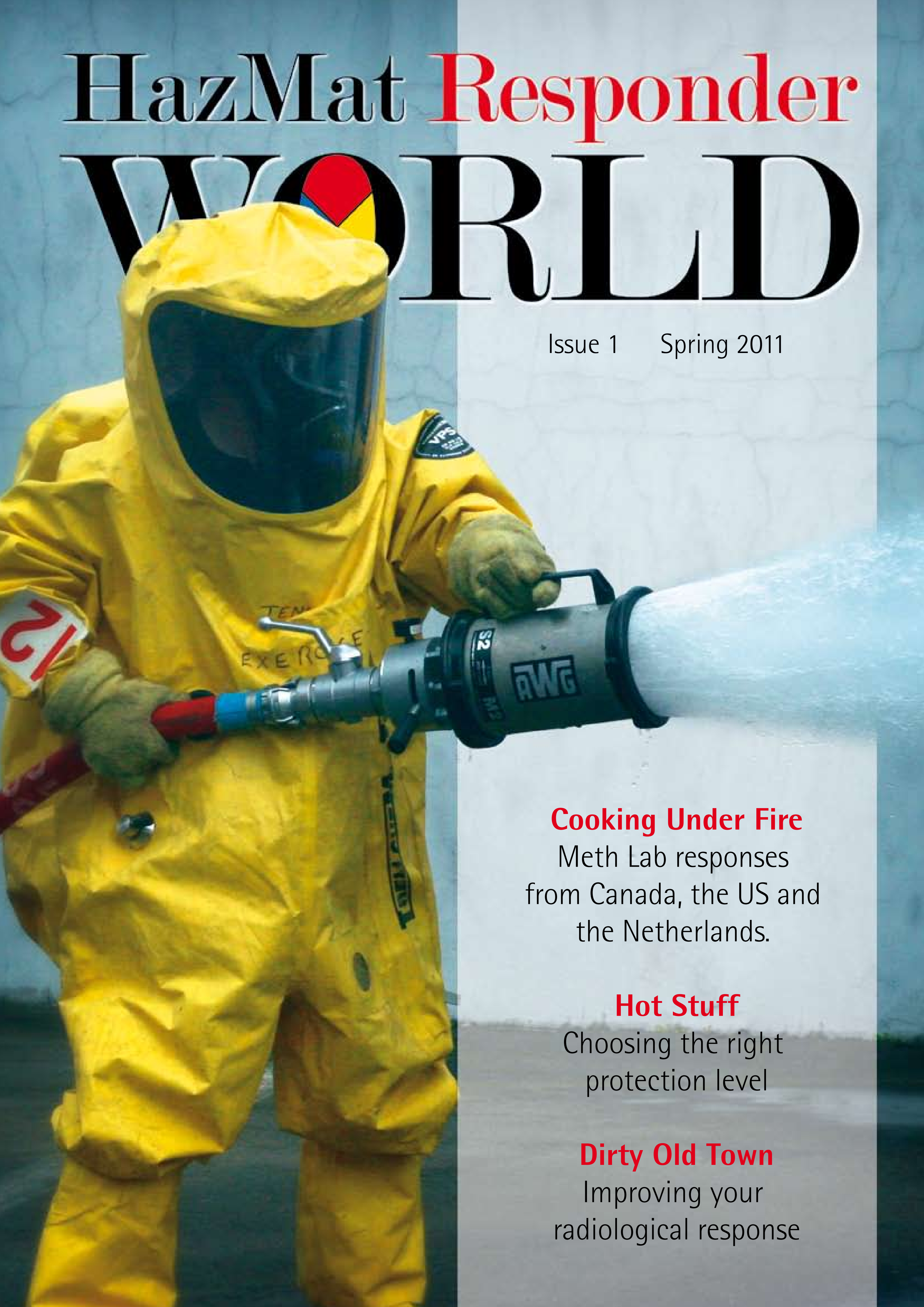


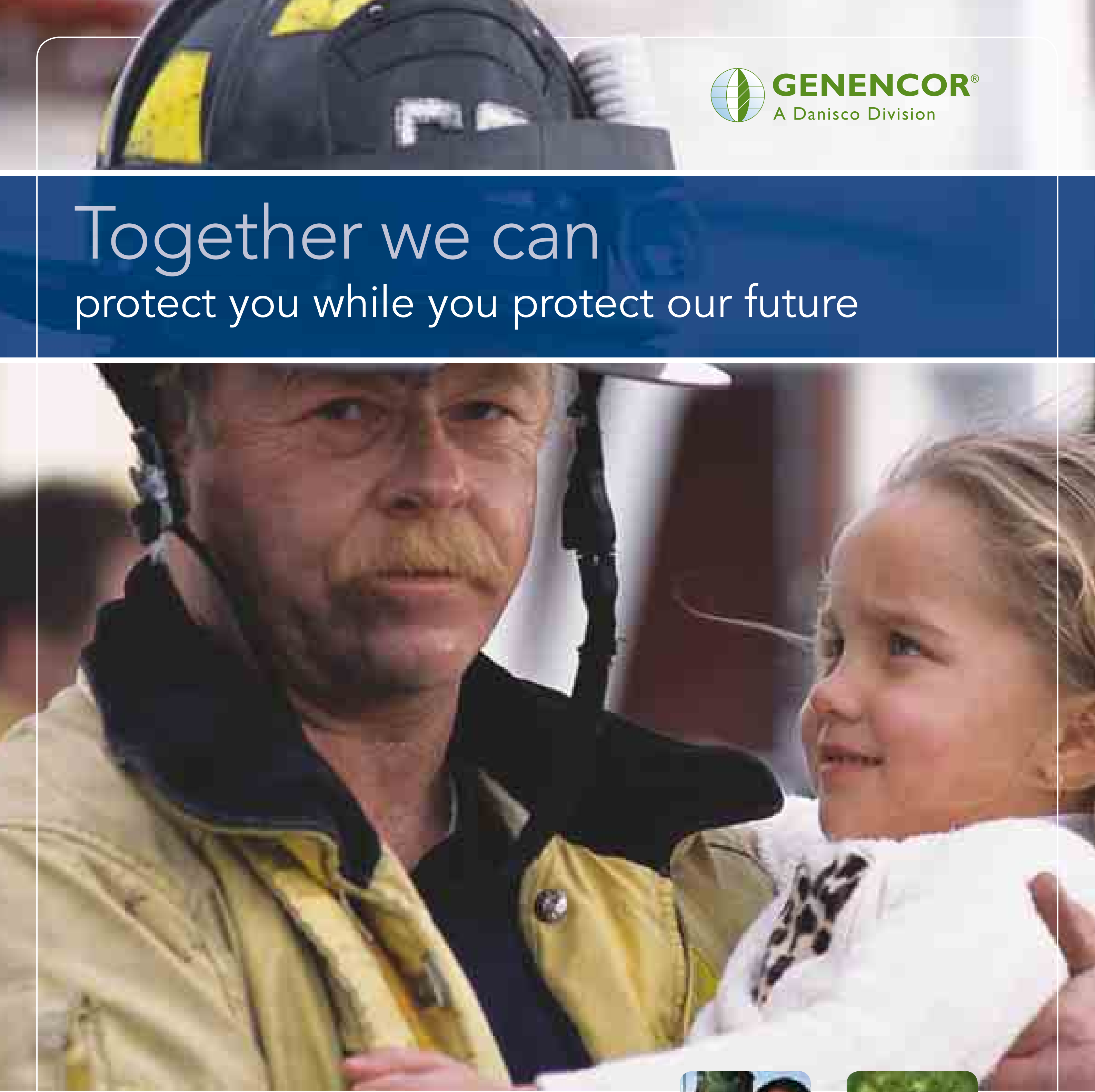
HazMat Responder WORLD

Issue 1 Spring 2011

Cooking Under Fire
Meth Lab responses from Canada, the US and the Netherlands.

Hot Stuff
Choosing the right protection level

Dirty Old Town
Improving your radiological response



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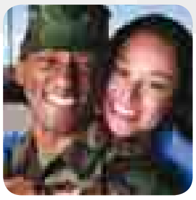

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HazMat Responder WORLD

Welcome to the first edition of *HazMat Responder World* magazine. *HazMat Responder World* is a new magazine from the same team that brings you *CBRNe World* (www.cbrneworld.com), which is the world's leading magazine for defence against chemical, biological, radiological, nuclear and improvised explosive devices. David Levitt, the Business Development Director, and I have been involved in providing insight and information on the CBRN (or even NBC!) field since 2003 and feel that we have a range of skills and expertise to provide you with this first rate magazine and website - www.hazmatresponderworld.com

Having over 40 years of publishing experience between us we understand what is necessary to produce a quality product, but more important than this is the sector knowledge that we possess. Steve Johnson, the Deputy Editor, and I have a wealth of CBRN knowledge from both the user and academic side, and are able to transfer a lot of that information directly to Hazmat Responder World; but we appreciate that there are real differences between hazmat and CBRN. As such we are grateful to all the subject matter experts and responders who make up the Editorial Panel for the magazine (see Page Four). They will guide Steve and myself, to ensure that we produce articles and interviews that will accurately represent the needs and requirements of the general *HazMat Responder World* reader.

Who do we see the reader being? As well as those individuals from the military and civilian sector who are hazardous materials trained, we also welcome readers, and input, from people that also work within that cordon, whether law enforcement, forensics or health, who might have valuable insight that they wish to share. *HazMat Responder World* will be a FREE magazine for the foreseeable future, we actively want to build a broad community and want it to be an active one. The magazine will be published twice in 2011, in May and October, and then shift to a quarterly basis in 2012.

CBRN and Hazmat share many similarities, one of which is the enthusiasm that experts have for their field, however, the sharing of information and lessons learned between forces are very different in the two fields. CBRNE, due to its military roots, has always had a healthy approach to classification, with all the best information kept out of sight of 'Red Force.' Hazmat technicians, however, appreciate that the majority of their tasks are the less exotic; the spills, accidents and routine incidents that make up day to day life, and as such are more prepared to share information that might be useful and life-saving. We, at *HazMat Responder World*, hope to be part of that information sharing nexus.

Therefore in this issue you will find articles from a range of experts on everything from Clandestine Laboratories, Radiological Detection, Protection Levels, Methane Accidents in Underground Facilities, the difficulties of distance, and the capability of one of the world's leading Fire Departments – FDNY.

Should you have any queries, or ideas for stories, please do not hesitate to contact me at: gwyn.winfield@hazmatresponderworld.com.

Your Editor,
Gwyn Winfield

Co

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Welcome to the Hazmat Responder World Editorial Panel

Eight experts covering the Hazmat challenges that face responders across the world

Chief Robert Ingram – FDNY

Robert Ingram is a Battalion Chief in the Fire Department, City of New York. He has 25 years of Hazardous Material Operations assignments and is now assigned to the Center for Terrorism and Disaster Preparedness as the WMD Branch Chief. Chief Ingram is a national instructor in hazardous materials and worked on Bio and Radiological planning at the national level. He chaired the Inter Agency Board (IAB) for CBRNE Equipment Standardization for 4 years, holds a Bachelor's degree in Fire and Emergency Management and is currently pursuing a Master's Degree in Homeland Defense and Security.

Chief Christophe Libeau – Paris Fire and Rescue Brigade

Battalion Chief Christophe Libeau, Director of the HazMat & CBRN Training Center of the Fire Rescue Brigade of Paris (FRBoP). Chief Libeau has a M.Ph. in history and political sciences and entered the Army in 1994. As a junior officer, he served in the suburbs of Paris and took the command of the 4th Fire & Rescue Company in the historical heart of Paris between 2001 and 2005 and then served as an staff supply chain officer for the 3rd regiment of the FRBoP. Since 1996, he had obtained technological diploma in both civilian safety and military frames: chemical and radiological Technical Advisor for Incident Command Chief, military CBRN Corps and Staff officer. He is also the Competent Person in Radio Protection of the FRBoP, responsible for labor legislation about radiological exposition of Parisian firefighters and conformity of measurement apparatus. In 2008, he became chief of the HazMat & CBRN Training Center of the FRBoP and the Deputy CBRN Technical Advisor of the Major General of FRBoP. He participated in, or piloted, several working groups, including: "Yellow Plan", Parisian fire service battle plan against CBRN terrorist attack and 'Methodological guidelines for firefighters in case of biological interventions.

Chief Kim Ayotte – Ottawa Fire

Kim Ayotte is the Chief of Special Operations for the Ottawa Fire Services, the fourth largest Fire Service in Canada. He is responsible for all Special Ops Teams including the Hazmat/CBRNE Team, Water Rescue Team, Technical Rescue Team, USAR, Extrication and Rapid Intervention Programs. He also manages one of three Provincial CBRNe response teams. As the lead for the Fire Service he was instrumental in developing the Ottawa CBRNe Task Force Response plan. He gained a degree in law and started his career with the Ontario Provincial Government as a Special Investigator with the Ministry of the Environment, Investigations and Enforcement Branch. He then moved on to become a Fire/Explosion Investigator with the Ontario Fire Marshal's Office where he later became a Supervisor then Operations Manager. He has testified and has been declared an expert witness on Explosions and in the field of Fire Investigations in all levels of court in both criminal & civil proceedings.

Ian Fensom – Moreton in Marsh, UK

Ian joined Greater Manchester Fire Service in 1975 and retired in November 2010 after 35 years service. Serving in mainly operational roles throughout he progressed from firefighter to Group Manager. From 1991 worked mainly in the inner city areas of Manchester and in 1994 became Station Commander of Philips Park Fire Station which contained a high number of chemical companies, four of which were major sites covered by the COMAH regulations. In 2001 he was asked to take over the role of Brigade Hazmat Officer for Greater Manchester and during this time the concepts of Detection, Identification & Monitoring were coming to the fore as a result of 9/11 and the heightened CBRN threat. Having served on numerous national and local forums he was involved from the start in the development of the FRS DIM capability and is now specialising in training personnel attending the Fire Service College in the use of GC/MS, Infrared Spectrometry and Radiation detection and monitoring devices.

Eric Yap – SCDF

Assistant Commissioner (AC) Eric Yap is the Senior Director of Emergency Services in the Singapore Civil Defence Force (SCDF). His office oversees all aspects (covering policy development, training and operations) of emergency services provision (i.e. fire-fighting, rescue, Hazmat, unconventional threats and emergency ambulance response) in Singapore. Prior to his present appointment, AC Eric was the Senior Director of Homefront Security Division at the Ministry of Home Affairs (MHA), responsible for the development of national security policies and managing the implementation of security measures and capability development on counter-terrorism. In his 17 years of service, he has held a variety of appointments largely in operations, such as Director of Operations, a Division Commander in SCDF and three years as an Asst. Director in MHA developing national crisis preparedness policies and programmes. He graduated from the UK in 1993 with a first-class BA (Hons), in 2000, he was appointed as a Foreign Fellow under the US Fulbright Programme and graduated from Emerson College, Boston, USA, in 2001.

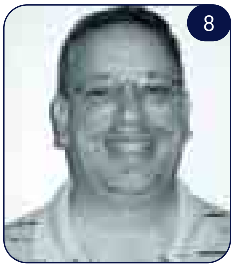
Dr Michael Logan – Queensland Fire

Dr Logan is the Director of the Queensland Fire and Rescue Service (QFRS) Scientific Branch. The Branch provides expert advice to ensure the safe management of hazardous materials incidents principally within Queensland, but also other jurisdictions within Australia. Mike has a PhD in Physical Chemistry and has undertaken Post Doctoral Research in Canada. He has completed Hazmat emergency management technician and specialist courses in Canada and the US. In his current role as Director of the Branch he has provided advice to about 1,000 incidents. He is a member of many fora at state and national level including the Australasian Fire Authorities Council (AFAC) Hazmat working group and provided subject matter expertise to many national areas such as the Australian National CBRN Working Group. He provides expert advice across a range of areas including emergency risk management –assessment and risk control measures, detection, mitigation approaches, sampling and hazard prediction within these groups.

Col. (res.) Dr Efraim Laor – UNDAC

Dr Laor joined the Israeli Defence Force (IDF) and was active in the October War, Litany Operation and ended up his spell in the IDF as Director of Operational Planning during the Gulf War of 1990-1991. Following this he became a Senior Staff Member within the Prime Minister's Office responsible for national planning, as well as being a Scientific Advisor/Board Member for other National authorities. He was part of the FIRST (Fast Israeli Rescue & Search Team – of which he eventually became Head) Mission to Turkey and also attended other earthquakes and disasters, such as India, Peru, Thailand and Darfur. Until 2007 he was Chairman, Government of Israel National Steering Committee for Disaster Reduction, in charge of initiating and coordinating the comprehensive governmental and public sector activities aiming to reduce loss of life and all kinds of damage caused by earthquakes and in 2007 became a Team Member of the United Nations Disaster Assessment and Coordination. He has a PhD from King's College in "Policy, Strategy and Administration of Large Scale Emergency Situations and speaks four languages.

Chris Hawley – International Association of Fire Chiefs



Chris is a Deputy Project Manager with Computer Sciences Corporation (CSC) with responsibility for WMD and Counterproliferation courses within the DOD International Counter-proliferation Program (ICP). This cooperative program with the FBI and DHS provides threat assessment, HazMat and Anti-Terrorism training and full scale exercises worldwide. Previous to this position Chris was the Special Operations Coordinator for the Baltimore County, MD Fire Department. Chris has been a firefighter for 24 years and a HazMat responder for 19 years. He is the author of several HazMat and Terrorism response texts with Cengage-Delmar Publishing, and is the co-author with Greg Noll and Mike Hildebrand for *Special Operations: Terrorism and HazMat Crimes.*

HazMat Responder World News

Product Watch

Controlling ambition

Dycem released their contamination control floor coverings and mats at the UK's Counter Terror Exhibition (CTX) in April. Dycem uses a short range Van de Waals electro-magnetic force to pull conventional particles from the air and trap them on the mat, and if they are biological they are then inhibited by the use of embedded silver ions. The mat can then be cleaned and all particles removed for safe disposal/collection. The system is largely based around foot and small wheel/tyre traffic, and as such has a variety of applications – though driving your hazmat vehicle over it might not be one! It also requires a certain amount of contamination control, to ensure that the covering is swept clean and not just a dump for contamination. Tests done by 3M shows that 80% of all contaminations enter buildings on either feet or tyres, while GlaxoSmithKline's research showed that these coverings prevented 99.9% of all contamination being spread. It will be interesting to see what impact these mats would have on CCA areas in mass decontamination...

Environics release bio detector

Environics also launched two new products at CTX, their ENVI BioScout and their Mobile CB detection module. Environics have gained appreciation worldwide for their ChemPro product and recently their improvement on it, ChemPro PD, and have now launched a new bio-luminescence product, their ENVI BioScout. The system continually samples the area, when it excites targeted particles in the .5-10 micron range, it pulls a sample that can be run through a (not provided) confirmatory/identification piece of technology, such as PCR. The BioScout is designed for facilities, but their alternative version of it, the Mobile CB Detection Module, is suitcase sized and includes their ChemPro chemical detector to allow the system to be pre-deployed at high value events or as monitoring stations after a hazmat/CBRN incident.

Feeling closer

Meanwhile at the Emergency Services Management in Canada show Feeling Software were showing their Common Operating Picture system Omnipresence 3D. Now, the Editor has sat through enough briefings in his life to get the 'IT Nod,' – the 'Sure it is... Yup, next generation... Going to change the way we do business...' – which often translates into 'Seen it before, no-one wanted it then either,' but Feeling Software might actually have something. Like many other systems they layer their platform over an ESRI Arc GIS map, they can then map various items like GPS, motion detection and access control etc., onto it. What caught our eye, however, was the fact that the GUI is instantly recognisable to anyone that has used the Streetview of Google Maps; the architecture of which they were instrumental in creating, which means that the training burden is low, but it also has the ability to automatically slew CCTV onto the target. So if you are interested in tracking a subject running from a scene, and are presented with the usual hide and seek of a bank of CCTV monitors ("Where'd he go... Oh, there he is! No, gone again... And there!"), this now cues all the cameras automatically, so you only have to watch one screen, and you don't need to know the order of cameras/screens as they automatically change to the camera on where the subject appears. There are lots of other clever elements, so if you can see a door access pad on a screen all you need to do is click on it on screen, enter the code, and Abracadabra the door is now opened. Clearly there is a certain amount of work to be done beforehand, to build the network – which is always the problem – but there are a number of nice touches all wrapped up in a recognisable GUI.

Down on the Japanese range

US robot manufacturer Qinetiq announced that they had sent their Small Unmanned Ground Vehicle (UGV), Dragon Runner, their larger more radiologically capable UGV, Talon, and their Bobcat loader with applique kit, into the Fukushima Daiichi Nuclear plant in Japan. The operator of the Plant, TEPCO, have now also been trained in their use and are sending the Dragon Runner in as a set of eyes on small spaces. The Bobcat loaders are also being used to do excavation, route clearance and demolition, whilst the Talon is doing fine motor skills like grasping, lifting, turning valves and repairing systems. We will try and find out more for future issues of HazMat Responder World.

Speed of Lightsquared

Lightsquared, the 4g-LTE communication network, announced a number of new initiatives. Their new network is working hard at co-existing with GPS systems; they have spent $9 million to manage interference between the two systems and are working with the US GPIC Industry Council to resolve the issue. They also entered into a bilateral roaming agreement with the US's largest privately owned wireless provider, Cellular South, which will allow them coverage in rural areas where there is no terrestrial network. This was quickly followed by another agreement with SI Wireless to bring their network into parts of Illinois, Kentucky and Tennessee.

Memphis becomes latest AmbuBus user

The City of Memphis Fire Department became the latest user of First Line Technology's AmbuBus kit, which transforms buses into ambulances via the inclusion of a stretcher kit. This allows conventional buses to be transformed at no notice into mass casualty ambulance buses at a far lower cost than buying the specialist platforms. Even though Memphis will leave the kit in situ, as a permanent capability, the kit can be transferred should there be a need to transport a dozen patients.

Everyday Decon!

Kaercher Futuretech announced a new concept in decontamination, something that would be of value in everyday hazmat incidents, rather than the classic WMD mass decontamination – the DRDS1. This was launched at the Global Security Asia show in Singapore and is aimed at the typical hazmat spill contamination – with perhaps only two or three contaminated casualties. The decon starts with the contaminated individual being wrapped in a blanket, which adsorbs any gross contamination on the skin and neutralises it, the individual is then lifted into a special stretcher which has a device that allows the casualty to be rocked from side to side – meaning that decontamination can be done at less physical effort from the responder but with greater efficacy.

There can be only One (Suit)

Saint Gobain announced that they had extended the shelf life of their One Suit to ten years. This is three years more than it was first thought and comes on the back of extended testing involving accelerated ageing and resistance. Their one suit has been tested under harsh conditions and they state that the initial purchase of a limited life One Suit Pro is less than half that of a reusable suit and can be disposed of once contaminated – as they put it "without the hassle of ensuring full decontamination…" Meanwhile at FDIC, Saint Gobain launched their new Level B hazmat suit, OneSuit Shield, certified to NFPA 1992 for splash and 1994 Class 2. Saint Gobain feel that this rounds up their capability to a full portfolio of Level A and B suits.

Splish splosh

Thermo Fisher Scientific announced that they had partnered with patrol-boat manufacturers Brunswick to include their Matrix RadSPEC series on their host of border and harbour patrol watercraft. These will have gamma and neutron detection, come in a weather-proof case, and allow the data to be handed off to other officers in real time. The first radiological detection equipped craft was the 350 Challenger Boston Whaler, which was delivered to Lorain County Sherriff's Department in Ohio.

Threat Watch

Fukushima poses questions to all
The on-going disaster at Fukushima Daiichi has posed major question marks for all governments and states involved with nuclear power. Perhaps the most obvious sign for this has been the purchase from one government, state, agency, company or another of nearly all the radiological detectors that money can buy – certainly the shelves in the UK are empty. Protests have been rife in France and Germany and activists in India have threatened to kill themselves to stop a potential 'Fukushima' happening there. An additional inhalational hazard will have been caused by all the dust blown off various contingency plans, as people tried to assure various officials that the plans were up to date, practised regularly and had triple contingency to ensure that they were protected against mega-tsunami, asteroid strike or rain of frogs. The release of radiological material was tracked as far away as Glasgow in the UK and Reno in the US, however it is unlikely to pose a threat to human health and life except as within some form of bio-accumulator, and a great deal of effort is being put into tracing isotopes in substances such as milk.

Four injured in Massachusetts chemical plant
Following a fire at the Bostik Inc. plant, a blast damaged two buildings in the complex, shook nearby houses and raised further concerns over air and water safety. The four individuals that were hurt by the blast were decontaminated at a local hospital and later released. Local hazmat crews announced that preliminary tests of water and air quality showed no causes for concern, though the cause of the blast is still under investigation.

Hard to swallow
China's State Council admitted that over the past nine years 151 materials had been added to their blacklist for substances not allowed into food or feed. 47 of these are inedible materials which might be added illegally to food, 22 are abused food additives and 82 are forbidden in food or drinking water. They have also re-categorised other substances as hazardous and upgraded safety limits – start booking your table!

Pennsylvania gas well blast injures three
A fire and explosion at a gas well in Independence, Pennsylvania injured three workers as they transferred water in a gas extraction process called hydraulic fracturing. Two of the workers were flown to hospital for immediate attention, while the third went by road. Hydraulic fracturing forces sand and chemicals into shale at high pressure, to shatter underground shale and release gas, and the fire and explosion is thought to have been related to this. This followed a previous gas explosion in eastern Pennsylvania that had killed five people, including two children. CBS suggests that this is raising further questions over the nations ageing 2.5 million mile network of pipelines.

I knew I saw them somewhere!
Iraqi police announced that they had found a large stockpile of chemical weapons and explosives in a district south of Fallujah. The three ton stockpile was concealed in a garage, and was only discovered after a tip off from local residents (wouldn't you?! Not the best neighbourhood attraction!). The chemicals were the 'wrong' sort in that they were not pure chemical weapons, and were instead chlorine, phosphorous and carbonate potassium. Ultimately desperately unpleasant and would have left a lasting emotional impact on anyone in the vicinity, but not WMD.

China loses nine to chemical blast
The Chinese State News Agency announced that an explosion at a chemical plant had killed at least nine workers. The cause of the blast in Daqing, in Heilongjiang province, was not immediately known, but it damaged a three storey building belonging to the Fuxing Chemical Plant.

Now. Who can spell boom?
Seventy primary school children were being tested for asbestos in Berkshire, UK when a science experiment lifted insulating boards containing asbestos. A hydrogen balloon experiment ended up in a 'sonic reaction,' dispersing the dust over the children, who ended up being sent home in their sports kits. Health and Safety Officers did some tests which came back positive, albeit at very low levels, and the hall has been sealed off.

Say 'Aaaarrrgggghhhhhh!'
An office building in New Orleans was evacuated after a spill of chemicals used in root canal work caused skin irritations in a number of people that came into contact with it. About an ounce of formal crimosol was spilled on the floor of a dental office, causing two people who came into direct contact with it to announce that they had a skin irritation, followed by a further two people. The rest of the building was then evacuated.

Russia encourages openness in nuclear incidents
The 25th Anniversary of the Chernobyl incident was marked by the Russian and Ukrainian Presidents calling on the rest of the world to tighten up safety rules at nuclear power plants and to 'tell the truth' about incidents like Chernobyl and Fukushima. The ceremony paid tribute to the clean-up workers that gave their lives and the victims of the incident and looked forward to peaceful uses of nuclear energy. The Russian President stated that there was a need for truth in such matters that had been absent under the Soviet system (since all Russian Presidents – like politicians the world over – only tell the truth…), which was seen as a veiled criticism of the Japanese establishment.

City that never sleeps

Chief Robert Ingram of the Fire Department City of New York (FDNY) Center for Terrorism and Disaster Preparedness, tells Gwyn Winfield about their hazmat work

GW: New York is an interesting hazmat challenge, unlike other cities that have major industrial centers, New York City's challenge is one of their high population density and the problems associated with that. What is an average NYC hazmat incident? What do you see the most of?
RI: Regular field units see a tremendous amount of hydrocarbon spills in vehicle accidents, and in the colder months we see a tremendous amount of home heating spills within structures, whether private, occupied multiple dwellings or commercial high rise. We get a lot of Carbon Monoxide (CO) calls and these are handled by the regular field units unless they involve multiple buildings, need multiple meters or if the incident commander determines the skills and equipment of the hazmat technician or specialist Company would serve the needs of the incident – those are the most common ones. We receive a lot of natural gas leaks, many in private residences or apartments from appliances or meters, but occasionally we respond to large distribution line breeches that make the trade magazines, where the high pressure line malfunctions or experiences a construction accident and the leak or fire spreads to multiple floors or buildings. Our infrastructure is aging and being updated, but in the mean time we experience leaks in the system. We respond to a lot of unknown chemical odours, which can be deceptive even when they turn out to be nothing hazardous or dangerous. Hazmat technicians arrive and have to deal with a completely unknown odour and are forced to identify it from various sources of information; the callers description, detectors carried by the field units, the location - whether there are sewers or landfills, sanitation areas, or traps that release sewer gases, activities that my be ongoing in the vicinity or recently stopped, and others. This is a challenge that requires a lot of skill: to narrow down the unknown until you have made a determination that you have found the source and that you can stop it, or are certain with an acceptable degree of confidence that there is no hazard and can secure the scene and return it to the owner. We have carried CO meters on our 140 ladder apparatus for years, but recently we added CO detectors to our 250 plus ambulance units and 200 fire engines as well. This gives us the capability to to have a CO meter on scene with every response, to see whether there is anything CO present that could hurt the patient or our own responders. We experience a number of calls regarding abandoned chemicals, drums or packages at the side of the road, containers put out with the trash – either inadvertently or intentionally – as well as companies that go out of business and leave their waste behind until a neighbour complains about the odour. We respond to fires involving chemicals, or that are exposing chemicals, and the incident commander wants an assessment of the chemical container condition, release of any toxic or corrosive material or potential for heating of materials based on the heat temperatures that are adjacent to it. The Marine Division Fire boats are dispatched several times a year to releases and spills from some of the barges and tankers that are in the NYC harbour and rivers around Manhattan – the majority of these vessels carry petroleum products but we do experience other releases, fires and occasionally explosions that have to be investigated and managed.

In both our winter and summer seasons, we experience problems with electrical transformers. In the heat of the summer they are overloaded by service demands, and in the winter during snow storms they short out when melting snow and ice, combined with road salt seeps into the underground vaults. In addition to the fire and electrical hazards, this also produces a lot of CO that travels through the conduit lines into the city buildings.

Battery back-up systems for all the computer banks in buildings are becoming more of a common concern and response, both in financial buildings where they use hundreds of computers twenty-four hours a day, or in communication hubs where they operate battery back-ups to maintain their operation. Often the rooms that house these battery banks were not originally designed for this purpose and they are not adequately ventilated creating overheating conditions and sometimes a build up of corrosive fumes.

With the age of many structures in New York City, the tunnelling and sewer systems, new construction and renovations, sewage and water treatment facilities, tanks and other unique locations, we are dispatched to numerous confined space emergencies requiring air-monitoring, patient treatment, stabilization and technical rescue resources and personnel.

GW: One of the worrying trends in Japan, and other areas of high population density, is hydrogen sulphide suicide poisoning. Have you had any major problems?
RI: We have seen a couple of chemical suicides in New York City, but not as many as in other parts of the US or Japan. Our Intel team at the Center for Terrorism and Disaster Preparedness have monitored the chemical suicide trend and have published documents on the weekly FDNY *Watchline*, (a widely disseminated open source awareness brief for FDNY and other fire service personnel and many in other disciplines too), and in the Centre for Terrorism's *Fireguard* project. Of the few that we have monitored in the United States and abroad , most deal with vehicles, and the person committing suicide placing

a note on the vehicle to warn emergency responders of the hazard. We have, however, had two chemical suicides that have taken place in multiple apartment dwellings where they have taped off the doors to the hall, the inner hallway and the bathroom, then mixed the chemicals there. We have focused our efforts to provide current information on this response type through our two Intel documents including what signs to look for, the chemicals involved, their hazards, appropriate personal protective equipment and the safe tactics to implement

GW: Major challenges facing other hazmat teams are illicit drug labs. NYC has traditionally had a drug problem amongst certain elements, has this transferred itself into Clandestine Labs?
RI: We haven't responded to many clandestine drug labs in the city the past few years, certainly not as as many as other agencies in rural areas of the country. With our population density it is hard to operate a lab with the chemicals common to them without being detected by distinguishing odours, empty containers and other signs. Even though people think that NYC residents are callous to everything going on around them, they are actually quite observant and when something is out of place they provide calls to emergency responders for investigation. Several law enforcement agencies' responders in New York City are trained in hazardous materials handling and are equipped with the appropriate detection equipment and protective ensembles. When a lab is discovered and not in a condition that requires a separate emergency response fire company or fire based hazmat team, they have the capabilities to handle the situation as a law enforcement crime scene.

GW: Yet while there is not as large a heavy industry challenge as there is in other cities there is the major concern of terrorist activities. Compared to an 'unknown smell' these are quite exciting, so how do you keep the team focussed on the hazmat, the day job, rather than the more stimulating terrorist/disaster scenarios?
RI: It is not easy by any means. The city is a high-profile target for many reasons: financial markets, landmarks of freedom, the United Nations, associated embassies and dignitaries, large places of public assembly, sporting events, media rich environment, tourist business, populations density, and the list goes on. We do not have the industrial base that many cities in the United States have where the products are being developed and manufactured. NYC has regulations prohibiting some hazardous facilities because of the population density and the limited availability of large tracts of land and the cost further reduces the number. Because of the possibility of people

New York City has tightly controlled hazmat routes into and out of the city ©FDNY

New York City being a major terrorist target always has a balancing act between CBRN and hazmat ©FDNY

bringing materials in the transportation that occurs over the highways and rail networks, we need to be concerned about the larger scale events as well as the small daily ones. One of the big issues is coordinating the efforts of the numerous agencies that are located here in the city. Local, State and Federal resources all have a mission in the protection, prevention, response, mitigation and recovery mission areas. In prevention you have several dozen law enforcement agencies involved with a large presence in NYC. there are a many more local, state and federal agencies in the recovery side – health, environmental, Coastguard because of the water routes around the city, etc. Cooperation and coordination is a big key. When looking at large potential events, accidental or intentional, we realise that it is more than a one agency response, it has to be regional in many cases and it requires the development of relationships. Our field units are the tip of the spear, the first units that would pierce the hazard zone perimeter, and it is important that we keep their knowledge and skills as high as possible and have personnel demonstrate them on a regular basis. This knowledge base helped our field personnel with the VBIED [Vehicle Borne IED] in Times Square. They arrived on scene within five minutes and sent their assessment of the event to other responding units, both second tier and specialist companies, which is critical in successfully managing these types of events.

GW: You stated in a previous interview (*CBRNe World*, Autumn 2009) that you felt that the pendulum had shifted too far in favour of CBRN and further from hazmat - but nothing focuses minds like an attack – and there have been attempts on NYC since then. So how has that finding of the balance gone?

RI: It is a challenge and since the last time we spoke we are getting better at balancing the two – hazmat and CBRNE – but we have to maintain it and keep working at it otherwise it will shift again, one way or the other. To have a strong CBRN capability we have to have a strong base hazmat foundation. A lot of the Federal Government training was focused on the CBRN delta, but you can't come off the street and train for that without the base hazmat knowledge, that would unsafe and ineffective in my opinion. We have to maintain the hazmat base to have a strong CBRN capability. We have had attack threats and attempts, what has helped with the more recent events has been the stronger security on military stockpiles and stricter controls on commercially available highly toxic or explosive materials; these security measures forces people with the intent to attack to make their weapons using commercially available products. This effort indirectly supports the hazmat base foundation. If hazmat teams understand that the weapons that may be used against them are common chemicals, commercially available materials that can be purchased in hardware stores or [plant] nurseries, it strengthens their situational awareness when they come across these ingredients in small containers and they look for the indicators and other factors that might be present that shifts the incident from a possible accident to a potential suspicious event. The VBIED in Times Square used components that were all commercially available. Immediately after the Times Square incident NYC responders received several calls from civilians spotting small flammable storage containers in vehicles that were unusual transport vehicles. In one incident the emergency service agencies worked together to identify an off-duty landscapers personal vehicle that was observed with a couple of cans of gasoline in the rear, visible to passers-by who called 911 . 'If you see something, say something,' which was the transit campaign here in the city has now been adopted by DHS. People in NYC do understand the value of being aware of their surroundings and notifying emergency responders who investigate and differentiate between a normal occurrence and a suspicious one - but you have to have that base hazmat foundation.

GW: Something that you, and many others, were personally involved in was the events of 911. How important are the lessons learned from that to the on-going development of the force? Are they still relevant, or has so much happened in the period since then that it is historical significance only?

BI: There are a couple of points of value in your question. We have a much younger force today, a good percentage of which were hired after 911. We have seen many experienced firefighters, fire officers and emergency medical personnel retire since 911. Our newly hired personnel do not have the experience and knowledge gained from operating during that response and recovery operation, it is more indirect knowledge hearing it from others. We need to provide them the information learned in training development programs and refresh them as necessary The longer people are removed from the tragedy of an event the more they tend to overlook it and become complacent, particularly in difficult budget times and priorities shift. First responders are no different from the general public. We work to prevent complacency through a continual refresher programe and we distribute updates of important information through

Department orders and our Intel *Watchline* and *Fireguard* documents.

One element that is a continuing problem involves information sharing. More of the information sharing challenges are in developing relationships and setting policies at the top levels of command in our key agencies than technology issues. Necessary and critical information must be shared with all agencies in real time or as close to real time as possible. Our agencies have been working to develop this capability for several years now, but sustained effort is necessary to complete this project successfully. We all agree that not every piece of information needs to be shared. Some must be held back to protect sources or law enforcement activities, but other disciplines require information on the materials that may be used in order to identify the materials hazards that might expose or injure responders and the public and leads to possible treatment options. The hazmat, health and environmental teams need information to prepare for possible mitigation and recovery operations. A new challenge to sharing information between agencies is the increased need for local and state personnel working in disciplines other than defense and law enforcement to have access to classified intelligence or information. These disciplines, including the fire service, traditionally do not apply for, and maintain security clearances. Leaders from health and environmental agencies and emergency managers fall into this category also. Progress is being made toward solving this, but it is a slow process. Clearances are becoming more common for chief officers in large metropolitan fire departments including the FDNY, fire officers and fire marshals are detailed to fusion centers and terrorism task forces allowing access to new levels of information. At the federal level, efforts are under way to develop processes to share critical information to key leaders in the non-traditional security disciplines, when they need it, even without prior clearance. This will be a more effective approach with broader reach than simply developing relationships with single metropolitan local agencies. Up to this point, we have had to work with information that defense and law enforcement analysts have determined might impact our mission. This method has not always been on the mark. These analysts are not experienced with our strategies and tactics, or even familiar with them in many cases. Often they fail to make the necessary connections and information has not been shared. Some of the continuing problems are technical. Here in NYC for example, and in other high rise structured cities, there are still gaps in communications capabilities within high rise structures and during below ground operations. The FDNY and other fire departments are working on these issues with State and Federal partners for mixes of technology that can fill these gaps. It is not just the need for audio from field units to commanders but also the need to track responders electronically, share video, stored building information, receive real-time building protection system status updates and even CBRNe detection information as these are installed moving into the future. We are working on sharing building blueprints with field commanders on the scene, which requires a tremendous amount of data, as well as streaming video and stored photos of buildings, so they can see all dimensions of the structures involved. As a result, an incident commander and their aide can get a view of all sides of the involved structure without having to physically walk around the building footprint. It is pretty easy to do that for a private residence, but if you want to do that for a block wide high-rise in an metropolitan city, it is just too difficult. We want to give them the ability to do that electronically through a laptop to see the sides of the building, to see the top, the rooftop, to access security cameras that might be inside the building, to access building alarms, sprinkler data, all of it visible on a screen on a street while they are responding - this will improve their safety tremendously.

GW: NYC has a number of high value routes into the city, which pose a major challenge for both accidental and intentional release. What is your experience and training for hazmat in tunnels, how do you train for that without shutting them down, which would result in a major financial loss.

RI: We do that a couple of ways - though it is a challenge! There aren't many alternate routes, so we do have to shut them down, or partially shut them down when the incident hazards require it. But it is planned out with interagency planning groups and in a unified command structure. We have been increasing the number of inter-agency exercises in recent years and they have been very beneficial. They develop personal working relationships, expand each others knowledge of the various capabilities within the agencies involved and improve our city wide effectiveness through a coordinated effort. Many of the exercises are coordinated through our Center for Terrorism and Disaster Preparedness, working with the Port Authority, Metropolitan Transportation Authority (MTA), Office of Emergency Management, NYPD, Departments of Health and Environmental, and many others. Many of the drills are conducted in the middle of the night, or early in the morning on the weekends, where it would not have a significant impact on the use of those routes by the public. We have recently created scenarios in under river subway tunnels between the boroughs, where we have operated on the tracks working with multiple agencies to respond to and recover from scenarios that we put in play. We have exercised scenarios involving regular commercial highway vehicles leaking from accidents on bridges, requiring responders to shut them down and playing them out with multiple agencies.

We do have a strong point in preventing accidents and intentional acts to disrupt our transportation routes within the city. Several of the routes into the city are not normal routes for hazmat shipments, they are prohibited by regulations from traversing them and directed to a few specific routes into and out of the city so they can be monitored more carefully. We have good cooperation with the agencies (NYC Tunnels and Bridges, the MTA, Port Authority etc.), monitoring these routes and they participate in the inter agency exercises and planning. Many of the transportation routes are monitored by a network of detectors screening for hazardous materials. One in particular, the 'Secure the Cities' – program within the Domestic Nuclear Detection Office's (DNDO) is a regional radiological monitoring program screening traffic on land and sea. In commercial accidents we work quickly with the other agencies. One of the benefits to working with the other agencies over the years is getting the incident commanders from each agency together at an incident, talking to one another and putting all the agencies concerns on the table and developing one incident action plan with the overall aim of life safety. If we need to shut down a major transportation route and inconvenience a tremendous amount of people then we will do that to protect all those at risk. We do, however, take steps to avoid that because as you can imagine, with the volume of traffic in the NYC area, back-ups will extend for miles and last for hours. In one past incident we responded to a derailed LPG tanker in the borough of Queens that occurred in late morning between the morning and evening rush hour periods. We shut down the service in the area, made sure that the tanker wasn't leaking and was stable during initial activities and called in the additional external resources that were determined necessary by the agency representatives in the unified command post. While we were waiting for these resources to arrive from a distance away, the evening rush hour began. We reopened passenger rail service in the area, allowed the rush hour commute to go through while monitoring the event. After the commuter rush hour peaked and began to slow down, the outside resources arrived and were in place. We were able to restart the operation to recover the tanker and get it back up on the tracks and safely to move . We are very cognisant of trying not to impact the movement of people and vehicles, sometimes we have to, sometimes we can find alternative solutions. **HRW**

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Cooking with Mother

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Battalion Chief Mark Vedder, from Solon Fire & Rescue in Ohio, offers Gwyn Winfield practical advice on how to distinguish between different types of clandestine labs

GW: What has been your experience of clandestine labs? How many and of what type have you come across? Are they typically the garage/kitchen methamphetamine (meth) outfit, or grander affairs?

MV: My experience is of about three to four labs a year. We are fortunate in Northeast Ohio as we have not had the problems that other parts of the States have, for example, they find thousands of labs each year just to the West of us. Clandestine labs started as a West Coast phenomenon, and have started working their way East, so the largest number of labs are in the Midwest. What we are mainly seeing here is Mom and Pop labs, smaller labs for personal use and sales, and not the big sophisticated labs that other parts have seen.

GW: So when you enter a premises, what are the typical signs and symptoms that says meth rather than chemical homemade explosive (HME), or other esoteric substances? What signifiers do you look for? One of the substances that you mentioned in the IAFC (International Association of Fire Chiefs) Conference, for example, was Red Devil Lye...

MV: The key identifier for meth is pseudo ephedrine tablets and packaging, as almost every means of making it involves taking Sudafed tablets and synthesising them into meth. The signature chemicals are typically some form of combustible metal, such as lithium or sodium, and some type of acid, like sulfuric acid or hydriodic acid. There will also be a solvent of some sort, like acetone, lantern fuel, ether or isopropyl alcohol, as well as a strong alkaline. So it is that combination: Sudafed, lithium, acids, solvents and alkalis. You mentioned Red Devil Lye, and that just happens to have a high concentration of sodium hydroxide, so any product that has sodium hydroxide in it could be used. The meth cooks that we see tend to follow recipes as they don't have a chemical background – though they might fancy themselves as chemists – but we refer to them as "cooks" as they don't really understand the chemistry. They tend to be brand conscious, because they don't know anything about the chemistry, so the recipe said that it had to be Red Devil Lye because it has sodium hydroxide in it or it had to be a Coleman Lantern fuel for solvent purposes, then they will stick with that brand because they are not sure what the chemical makeup of other brands are.

Filters are also a tell-tale sign, as they take the tablets and grind them up to extract the Sudafed from the tablet material, and they need to pour it through a filter. Very often you will find a used coffee filter or t-shirt containing a red paste and that is because the colour typically added to Sudafed in the US is red. There will also be some type of blender or grinding equipment to make the tablets into a powder.

In the US the other chemical that is pretty typical of a meth lab is anhydrous ammonia, and a big challenge for the meth cook is how to store it as it is ultimately a liquefied gas. Early on they used a thermos jug, but a thermos is not a container designed for pressurised gases, so as a liquid it is still fine, but as it warms up and expands it takes up more space, and these things were exploding in peoples cars. They have ended up storing the ammonia in 20lb low pressure (LP) propane cylinders, which are generally used for barbeque grills. But the problem with this is that the valve at the top of the LP cylinder is not designed to be compatible with anhydrous ammonia, so it turns a green colour and the metal begins to break down and become brittle, so they only last a short time. They will thus constantly be turning over these LP cylinders, and if the container comes apart or the cylinder blows apart, then the anhydrous ammonia, which is an extremely toxic alkali material, poses a serious health hazard.

GW: The power of Google suggests that pop bottle, or soda bottle meth is one of the ways forward. What impact does this have? Does it then become easier to hide some of the signifiers or is the size of the cooking method irrelevant?

MV: The single pop bottle method of making meth is gaining some popularity, though it doesn't make the quality of meth that the other methods do. I think it is, however, a significantly more dangerous method due to the pressure build up in the

How sure are you that that was a Meth lab? What key signatures are there? ©*Solon Fire*

2L bottle. So, if you put in the wrong proportions or you don't vent it at the right times you create an acid bomb similar to the pop bottle pressure bombs that people use to blow up mailboxes. It has that appearance, it is acid in a plastic bottle and it could blow up in your face.

GW: Is it just meth that has such clear signatures, or are there similar ones for other substances as well?

MV: You have to look at the situation in its entirety, but there are some things that clue you into what type of lab it is. So for meth it is Sudafed, but for HME it is other chemicals, like fuels and oxidisers - there are no oxidisers in the other types of labs, so it is a key signature. The fuels could be something like petroleum jelly, diesel fuel or nitro-methane and the oxidisers will be hydrogen peroxide, potassium permanganate or potassium chlorate, so you will have strong oxidisers and fuels stored together. An example would be in a Triacetone Triperoxide (TATP) lab, where there is acetone as the fuel and hydrogen peroxide as the oxidiser. In HME there are other things that you need to put the explosive device together, which we call PIES: a power supply, an initiator (like a blasting cap), the explosive itself and the switch – so you might find cell phones, wiring, blasting caps, etc. The other key signature is the ice bath. You don't have ice baths in any of the other production techniques, as here you are trying to cool and slow down these reactions.If you don't slow down the reaction such volatile chemicals heat up and they could explode prematurely.

Biological labs, however, have different equipment. Biological breaks down into pathogens and toxins, for example, bacteria and virus as the pathogens and ricin as a toxin. You don't want your specific biological agents contaminated with other agents, like mould, as you only want the specific substance that you are going to weaponise. Hence, in other labs you won't have sterilisation equipment, like an autoclave, bleach or antibiotics as you would in a biological lab. In an HME lab you might have dust masks, but in biological labs there are higher levels of respiratory protection, and even equipment like gloveboxes, which are not present in the other labs. For bacteria to grow you need warmth and nutrition, so you will be looking at incubation equipment as well as agar plates specific to the bacteria trying to be grown. Another key signifier for biological labs will be a centrifuge, as they will want to spin their substance down, and you don't have that in other labs. For viruses you have to have a living host, typically eggs, although tissue culture (similar to agar but a liquid culture), or lab animals are used.. For toxins you will find something like ricin, but it varies with the toxin. You also have to have grinders to grind the castor beans and solvents to extract it (which are both also common to meth labs, so that one is a little difficult), but the final product will also need to be milled, so there will have to be milling equipment present. For radiological agents you can't really have a lab, but if you have it you will want to store it safely, so there will be shielding.

GW: Meth has many issues in terms of health. In your experience where does the worst threat to responders come from? The short term and things like a violent exothermal reaction during the cooking process, or some of the longer term carcinogenic problems that comes from prolonged experience over years of response?

MV: The threat is higher for law enforcement officers than fire hazmat officers, as most of our response is second tier. Usually law enforcement receives some intelligence and they'll raid a lab whilst meth is cooking, which is the most dangerous time.. There are a couple of different levels of things that we are concerned about: the solvents and the explosive atmosphere. One of the things that they are doing in this process is allowing

those vapours to evaporate off, the reason that they are using a solvent in the first place is to extract the stuff that they want out of the raw material and then allow the solvent to evaporate off, so what you are left with is a powdery residue; so you will have solvents in the air. What they want in a solvent is something that will evaporate quickly, a high vapour pressure, so if police officers go in with firearms, flash-bangs or anything that will create a spark which can lead to an explosive atmosphere. The second issue is the toxic gases that are present, like anhydrous ammonia. One of the chemicals that they like to have in the older labs is hydriodic acid, although it is difficult to get in the US - it has very few uses outside of making meth - so sometimes they will make it using iodine and red phosphorous from match book covers. One of the by products of manufacturing hydriodic acid is phosphine gas, which has a high odour threshold, so you don't smell it, but is very toxic. Ultimately, there is the threat of explosives, solvents and toxins in the atmosphere, along with corrosive and toxic gases. If, like SWAT teams, you don't have experience of labs, you might come across combustible solids and not know what they are. So how do we work around that? We encourage joint hazard assessment teams. We are not going to be present during a raid – that is not our role – but we can be available to help them interpret what they are seeing right away and then to assess the atmosphere and what personal protective equipment (PPE) is needed.

GW: While you might say that you have a lot less experience than other States, meth in Europe is a new drug and has not yet taken off to such an extent. In terms of lesser experienced crews, is there a methodology that you would endorse in terms of PPE – are there corners that you can/can't cut? Is Level A best?

MV: No, but there are ways to address it. For example, we encourage everyone that is using BDUs – like SWAT – that if they have an inkling that they will be entering a meth lab, they should wear flame resistant materials like Nomex or PBI, so the BDUs don't melt on their skin. In terms of respiratory protection, which is not uncommon as they are used to wearing it for pepper spray etc., they need to make sure they have the right canister, I would not suggest they wear airpacks, as if there is a potential of shooting firearms it doesn't make any sense to have a 4500 PSI rocket on your back! Thirdly, you can address a lot of problems with ventilation. Ventilate early on and continue to do so, so that you are constantly changing the atmosphere, which it is a good way to reduce the challenge. We usually go in Level B, as once you ventilate there are not a lot of corrosive gases in the air, and we are more concerned about skin protection on surfaces and the fact that 90% of the hazard is respiratory.

GW: How are you preparing now that the labs have started moving East? Is there anything that NFPA 472 (Standard for Professional Competence of Responders to Hazardous Materials Incidents) hasn't provided for? Are there any other modules or training sites that have been helpful in covering elements that 472 doesn't? If you were starting from the beginning, like many other fire forces in the rest of the world are, where would you recommend they start?

MV: I would start with clandestine drug lab training, as once you have that training you can build on it for the others. So you start to think about crime scenes involving hazardous materials, where there is also a fire threat, so you need to protect evidence and to recognise that it is a lab. You will, however, need to bring someone else in to identify what type of lab it is, like a hazmat team, to get the ball rolling whichever way it is going to go: narcotics, explosives, or Chemical/Biological. I think getting some basic clandestine lab training becomes justifiable in terms of what lab you will run into, as it will hold their attention as one might doubt whether one would actually ever run into an explosives lab, and they are probably right, but they could run into a messy drug lab and they can build on that. We have some good training programmes in the US for hazmat techs to be able to go to – Dugway for Chemical Biological and Nevada for radiological – but the one piece of training that would be useful is integrating all of that together into a formalised training programme on recognising labs. We can send people around the country to attend specific courses on drug labs or on chemical and biological weapons, but something is needed that integrates all that together – to identify what type of lab it is and then process it. We do some of that locally, but we need some higher level training where people have put a lot of time and effort in to a simulation to point out specific things. Whether that is in Ohio at a State level, or Federal I don't know. HRW

Is that Red Devil Lye I spy? Brand conscious Meth Cooks provide easy give-aways. ©Solon Fire


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Captain Marchel Zomer, Senior Clandestine Lab Expert within the Netherlands Police Agency, on their multi-agency illicit drug lab team

Above: The LFO is a multiagency team set up initially to deal with MDMA, it has not been adapted to deal with

Below: 'Sarge? I am really hoping that is not all cocaine!' There has been an increase in the amount of special a

Meth ©KLDP

ssignments ©KLDP

Putting the band back together...

The National Dismantling Facility (LFO; *Dutch abbreviation*) was established in 2003 as part of the 'Conspiring against MDMA' (*Samenspannen tegen XTC*) program, and has quickly developed into a strong element in combating serious organized crime related to synthetic drugs.

Presently, in 2011, the LFO consists of four senior police experts, who operate within the Forensic Investigation Team, as part of the in depth Specialization and Innovation Unit of the National Crime Squad, which is part of the Netherlands Police Agency (KLPD). They are occasionally supplemented by three specially selected experts from the Zaanstad and Eindhoven fire brigades (originally hazmat officers), who have been internally trained and screened by the LFO police. This is a unique structural multidisciplinary approach.

The LFO initially mainly addressed the safety aspects of dismantling MDMA (XTC) and amphetamine laboratories. Currently, however, LFO hazmat investigation expertise is often used in investigations throughout the Netherlands. This expertise is both visibly present during dismantling operations and invisibly present in the cooperation with various observation and swat-teams in covert operations.

The extensive knowledge and experience of the LFO experts in combination with specialist high-level detection and identification equipment, makes the LFO unique in the Netherlands and abroad, and provides significant added value for many criminal investigations directed at the combat of drugs.

By the end of 2008, the LFO had already developed a forensic facility for (synthetic) drugs, providing high-level expertise in the fields of:

- Safe drug lab dismantling.
- Effective crime scene investigation within an all-hazards environment.
- Development of a drugs equipment information system database.

The main conclusion in relation to the dismantling activities is that since 2008 we have seen an increase in special assignments. These have included the demand for LFO expertise in the field of risk analysis, and a crime scene approach when hazardous substances have been used. For example, safety around large-scale drug investigations by the National Crime Squad, big asbestos or hazardous investigations, incidents involving people becoming unwell by unknown causes, and frequent international requests involving drug and chemical expertise submitted directly to the LFO. Recently part of the LFO took part in the investigation of the big chemical fire in Moerdijk, that occurred in January 2011.

The LFO has its own professional training laboratory/ mock laboratory within the training center of the Zaanstad fire brigade. This training facility is unique due to the actual availability of various (live) production processes and the opportunity to practice with real chemicals, smoke, booby traps and open fire.

The LFO also frequently provides practical dismantling support, and gives presentations and teaching materials both in the Netherlands and abroad. On request, the LFO has built training labs for educational purposes in Colombia, Turkey, Belgium, Great Britain, and for the United States' renowned Drug Enforcement Administration Academy.

The LFO is also a member of the permanent executive core group in its capacity as a CBRNe member of the National Forensic Investigations Team (LTFO): two LFO members are LTFO safety and security advisors, and another two are CBRNe team members. **HRW**

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OFM and RCMP have trained in the Netherlands under a Europol scheme ©Greg Way

Clan Colours

Greg Way, Program Specialist with the Ontario Office of the Fire Marshal Community Safety Enhancements Unit (OFM CSE), suggests some best practice for clandestine labs

HazMat Convergence:
Since the events of September 11, 2001, the world of hazardous materials response in North America has evolved out of necessity. This evolution has seen an expansion of the scope for hazardous materials response teams (HMRTs) from incidents primarily involving the transportation and production of dangerous goods to include incidents related to weapons of mass destruction (WMD) or chemical, biological, radiological, nuclear, explosive (CBRNE) response. The relatively recent revision (2008 edition) of the National Fire Protection Association's Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents (NFPA 472), has formally recognized the need to establish relevant competencies for the roles of responders at a variety of incidents, including (illicit) clandestine drug labs.

By no means is this a revelation for those teams who now find themselves actively involved in the response and mitigation of such events. It is important to recognize, however, the challenges that clandestine drug labs represent for any jurisdiction as they strive to achieve a safe and collaborative team approach that involves multiple agencies, such as the fire services, paramedics and police.

What is a Clandestine Lab?
For some, terminology is everything. What distinguishes a Hazmat incident from a WMD/CBRNE incident or attack, or a clandestine drug lab for that matter? The reality is that a 'clandestine lab' may produce a variety of chemicals (e.g. methamphetamine, ecstasy), biologicals (e.g. anthrax), radiological/nuclear devices (e.g. dirty bombs), and explosives (e.g. Triacetone Triperoxide). It is a fact that the same hazardous materials that are transported on our highways, railways and seaways are also used for various criminal activities. Clandestine 'drug' labs use hazardous materials for the synthesis and production of illicit drugs.

I will let you debate the semantics, but one thing I know for sure is that regardless of the intent or activity, the necessary response level for ensuring the safety of the HMRT and that of the public and other support members at clandestine drug operations requires a collaborative team approach with the right skills, knowledge and equipment. When selecting terminology, 'criminal intent or activity' is generally considered the determining factor for how such incidents are described.

As a fire, paramedic or police first responder you should be able to recognize the indicators for any type of clandestine lab, know what steps to take to protect yourself and others, and make the necessary notifications. In some cases, you may not realize what you have until the 'smoke has cleared.' So have a plan before it happens!

The Importance of a Collaborative Team Approach:
Successful operations at clandestine drug labs require multiple agencies to work together in a safe and collaborative team approach to mitigate the immediate flammable, toxic and corrosive hazards for the responders and the public. As public servants, there is an expectation that this would occur. How many times have you heard a statement similar to, "When the public calls 911, they expect the cavalry to arrive"? Not only do they expect you to arrive, they expect you to have a working relationship for seamless operations. Operations at clandestine drug labs may not be a typical 911 call; however they are still not a place for traditional silos or rivalries that you may be familiar with.

Typically, clandestine drug lab operations are more controlled in that the scene has some sense of stability and control after a warrant has been executed; however they are also complex with a high degree of potential for fire, explosions, and very real exposure to unknown chemicals and processes. To be successful you will need to be an active participant, take ownership of your roles and responsibilities (mandate), and yet integrate operations into an overall collective objective as part of a team approach.

Each agency (police, fire, paramedics) may have their own expectations of what their roles are, who will do what, and how they will do it. Where do you fit? What can you really do within your own HMRT capabilities and limitations?

Some of the Expected Challenges:
The diversity of the fire service is a challenge. The capacity for HMR varies across Ontario's volunteer, composite, and full-time fire services as it does across North America. The capabilities and limitations of your agency's capacity to competently and safely support police operations at clandestine drug labs will depend upon factors such as your level of training (NFPA 472 2008 Edition Awareness, Operations or Technician), your personal protective equipment (PPE), other equipment and staffing resources.

Similarly, law enforcement agencies of different jurisdictions also have diverse capabilities and limitations. Specialized

It is important to clarify the role and expectations of the fire service prior to the operation starting ©Greg Way

clandestine lab resources in the form of trained investigative response teams exist across Canada within the Royal Canadian Mounted Police, across Ontario within the Ontario Provincial Police (OPP), and within some larger municipal jurisdictions. They very often share personnel and resources.

Advance notification and information regarding a pending take-down of any clandestine drug lab to fire and paramedic services is minimal, if any. There is the need for extreme discretion and selective sharing of information by police in order to prevent compromising the on-going investigation and the safety of the officers involved. Specialized drug units may not freely share information even amongst their own colleagues until a warrant is executed. Like it or not, this is a challenge that can only be overcome by building select relationships and trust amongst designated representatives from your agencies, over time. In my opinion, there is no substitute or magic wand for establishing familiarity and trust amongst the leaders of those involved other than face-time, open and transparent communication, discretion, and a willingness to acknowledge what the issues are and seek solutions. Lastly, not only does this take time, it takes commitment. Many of you will recognize that an effective relationship or partnership does not simply materialize because of one's rank or status.

While yet another topic for discussion, I would be remiss if I didn't identify a very real challenge for today's fire service and paramedics. Clandestine drug labs are unique crime scenes involving hazardous materials. The police are the lead agency under the IMS/ICS. These scenes often take days, staffing resources and require additional planning for such things as pre/post medical checks, paramedic transport, fire suppression, water supply, decontamination, rehab, scene control and security, rotation of personnel, specialized PPE and equipment. In the absence of a fire or injury, multiple agencies will be requested to have resources assigned in a support role for extended periods, which they may or may not envision as their responsibility, yet their presence remains a necessity to safe operations.

This leads me to the last challenge that may or may not be applicable to you as an HMRT member, but let me assure you that someone is looking at the cost of operations. Who is paying the bill for personnel, overtime, consumable equipment and PPE? Very often these negotiations take place behind the scenes; agreements are made and insurance companies contacted. Operations at a clandestine drug lab are not a typical 'emergency response,' where one simply assumes the financial impacts are just the cost of doing business. This requires municipal officials and affected agencies to have some discussion on these matters. This only emphasizes the need for an understanding of each other capabilities, resources, roles and expectations for working together when clandestine drug labs are discovered.

OFM/OPP Partnership to Combat Clandestine Drug Labs:

On June 16, 2009 the OPP and the OFM formed a community safety partnership to combat clandestine drug labs http://www.ofm.gov.on.ca/english/publications/press/2009/Jun-16-09.asp. Through this partnership and protocol, the OFM CSE Unit provides direct advice and assistance to the OPP by coordinating additional planning and resources as required. The OFM is in a unique position to provide the OPP with known and experiential information regarding the capabilities, limitations and level of hazardous materials response for Ontario's diverse fire services. Through this assessment of capabilities and limitations, the OFM CSE Unit assists with coordinating the anticipated resources to support safe, effective and efficient operations at clandestine drug labs, such as using existing fire service HMRTs. This formalized partnership has been successfully proven in the field. In Ontario, there are also nine fire-service based Provincial CBRNE Teams that may also be called upon to support operations. These specialized teams and equipment can be accessed as necessary through the OFM.

The Role and Expectation of the Fire Service HMRTs:

It is important to clarify the role and expectations of the fire service HMRT prior to commencing operations. When working with a trained police clandestine lab investigative response team, depending upon the capabilities of the fire service, the role will be of collaborative support and can be anticipated to include:

– Attending briefings; now is the time to ask questions, clarify your expectations and what the expectations of your agency will be.
– Communicate foreseen challenges that you will have; be honest with your issues and seek solutions.
– Clearly identifying primary contact and alternates; who will be in charge, when will they be in charge, and where will they be or how can they be contacted?
– Maintaining initial fire suppression and emergency decontamination capabilities at the ready; initial attack crew, pump operator, emergency decontamination.
– Arranging for self-contained breathing apparatus refills on a rotating basis; consider transport arrangements.
– Maintaining a rehab area and/or rehab arrangements for personnel; food, shelter, washrooms – keep your personnel fresh.
– Providing trained decontamination

personnel and required PPE to accomplish decontamination operations; including pools, air monitors, pH paper, decontamination solution, Level B suits; how will you test the effectiveness of decon?
– Relief and rotation of necessary personnel; remember, operations may take days.
– Replacement of consumables; suits and gloves for your own personnel.

In many cases, the local police will be working in conjunction with specialized police clandestine lab teams from outside the jurisdiction. We must be honest in that typically each agency has a propensity for looking after their own, however it needs to be recognized that a discussion should take place with respect to the simple things in life such as lunch, port-a-potties and shelter. There is nothing more demoralizing to personnel on scene than to have another agency's van load of pizza or sandwiches arrive as they are forced to watch longingly from afar! Remember, these are slow, methodical operations that require personnel to be in a state of readiness for extended periods of time and even days. Remember that collaborative team approach? If it breaks down on-scene, you will have difficulties.

The local Chief Fire Official or designate is not only a key player in successful operations, he or she is recognized as a primary contact for obtaining information on municipal contacts and notifications, accessing municipal resources, and for their existing relationships with key municipal players and departments. After all, this is their turf too! The public and responder safety component of the fire service mandate remains intact.

Joint Training is Important:
In late 2008, the OFM CSE Unit was invited to deliver a presentation to the participants of the Clandestine Laboratory Investigations Course at the Canadian Police College (CPC) in Ottawa. This presentation was focused on an Ontario based approach to marihuana grow operations and other clandestine labs, in which public and first responder safety issues, partnerships, and the utilization of expanded enforcement options available under the Ontario Fire Protection and Prevention Act, 1997, were presented.

This resulted in further discussions related to operational procedures and the various recognized levels of training for other response or support agencies, such as the fire service when operating or supporting law enforcement activities at clandestine lab incidents or scenes. The resulting discussions recognized that many response agencies, particularly fire services, are trained and equipped to operate at hazardous materials or CBRNE incidents based upon the internationally recognized consensus standard, NFPA 472, 2008 Edition.

In Ontario, the OFM provides or makes available certification (third-party recognition) through the International Fire Service Accreditation Congress and Pro Board accreditation agencies, based upon the competencies of the NFPA 472 Standard. The revised NFPA 472, 2008 Edition standard now has competencies for response to illicit labs, with recognition given to participating agencies such as Homeland Security, the FBI, US Capitol Police, National Sherriff's Association, and the National Association of Bomb Squad Commanders.

Clandestine drug lab operations pose a threat to multiple agencies and the general public, and are considered hazardous materials incidents or waste sites. They involve hazardous materials in the form of chemicals, chemical processes, and involve the increased potential for exposure to poisonous, toxic, corrosive, and flammable materials or atmospheres. The fact that these scenes often involve multiple agencies highlighted the impacts of the lack of adherence to shared or common recognized best practices or standards for those agencies, such as law enforcement and the fire services.

These potential impacts could include:
– Increased potential for injury or illness resulting from lack of adherence to shared or common recognized best practices or standards.
– Conflict amongst agencies that should be working collaboratively at clandestine lab situations.
– Public and participating responder perception that governmental agencies are not functioning as intended.
– Inconsistent or ineffective Operational best practices in the field, further placing 'tension' on the systems put in place to ensure responder and public safety.

Since early 2009, the OFM and CPC have worked collaboratively as partners to achieve the benefits of incorporating and adopting a recognized standard for all responders, such as the relevant components of NFPA 472. The OFM continues to support this ongoing initiative through active participation in program delivery at the CPC. This approach has received much interest and the participants continue to give positive feedback.

There are perceived benefits in adopting a recognized standard, such as NFPA 472, in that it:
– Establishes baseline or CORE competencies for multi-agency responders; from multi-disciplines.
– Provides consistency amongst agencies facilitating:
– Interoperability
– Defined roles and responsibilities
– Operational consistency under an IMS/ICS
– Shared CORE knowledge and understanding of terminology and best operational practices
– Effectiveness and safety best practices
– Provides flexibility to focus training programs on mission-specific competencies.
– Minimizes liability and meets employers obligations.

The challenges associated with multi-agency operations at clandestine drug labs remain ours to overcome. Respecting the role of other agencies and gaining an understanding of their capabilities and limitations goes a long way to establishing formal and informal partnerships. Establishing effective partnerships is highly reliant on building respect, trust and familiarity amongst key decision makers. In Ontario, the OFM and the OPP have realized the benefits of this type of positive operational relationship since 2009.

Disclaimer: This article is intended for informational and discussion purposes only and expresses the opinions of the author only. It does not constitute the opinions of the OFM nor the Ministry of Community Safety and Correctional Services. **HRW**

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These Are
the Threats
We provide
the Solution

A,B,C, it's easy as 1,2,3

Ian Fensom, Hazmat Resilience Manager at the UK Fire Service College, talks about Chemical Protective Clothing – Is your gas tight suit fit for purpose?

For many in the emergency responder community, attending incidents involving hazardous materials (hazmat) can be one of the most difficult responses. For the first on scene the task is generally one of recognizing the hazards and risks and ensuring that the situation is controlled, including not becoming a victim, moving people away, setting cordons, and calling for appropriate assistance etc.

Once appropriate assistance arrives the tasks can become more proactive by taking positive intervention steps to control and resolve the situation. The mechanisms that are currently taught to UK Fire & Rescue Service (FRS) hazmat responders are centred on a nine point risk assessment process that focuses on ensuring all the incident elements are considered and appropriate tactics are implemented. In conducting the risk assessment, the issue of selecting appropriate Chemical Protective Clothing (CPC) is inextricably linked with the hazardous material involved, and is a critical step in ensuring that personnel are not subjected to unnecessary risks when hot zone deployment is required.

In simple terms, the risk is generally accepted as that arising from the hazardous material, mainly corrosive, toxic, biological or radiological risk, and this is clearly the case where close proximity or direct contact is likely. The wearing of chemical Personal Protective Equipment (PPE), however, brings associated risks other than those of the hazardous material, and these must be taken into account to ensure safe operations.

No matter what the operation, the wearing of CPC is arduous. The wearer must be suitably fit to undertake the operation and suitably hydrated, particularly when the ambient conditions are hot. In addition to being fit to wear, the deploying personnel must liaise with the Hazardous Materials Adviser/Incident Commander to agree the dynamic risk assessment and type of protective clothing to be worn. Thus, the final part of the process is the selection of the appropriate PPE ensemble commensurate with the perceived risk.

At this point it would be decided whether Level A, B or C CPC or Breathing Apparatus (BA) and Fire Kit would be required to protect the wearer. This is a theoretical process. In reality, however, it is often not required in today's UK FRS response to hazmat incidents. The reason

Will this do? Suits need to be commensurate with the risk – but who determines that risk and can it be balanced? ©DoD

for this is fairly straight forward; most UK FRSs have settled upon the use of Level A (fully encapsulating gas tight CPC) as the norm for hazmat response and only carry this type of CPC on pumping appliances. Accordingly, they have removed any need to conduct any assessments other than: is CPC required or not.

Typically, hazmat responses do not require Level A protection so why then is Level B or C (non gas tight) CPC not the norm? In essence the answer boils down to one of utility. Space on a modern FRS pump is limited as there is extreme pressure to carry as much equipment as possible, and due to legislation limits, or even precluding any type of improvisation, every piece of equipment carried has to be used only for its designed purpose. As a result there is generally only enough space to carry two sets of CPC.

If a lower level of CPC were to be carried (Level B or C) on first responding pumping appliances, then problems would arise if the crew were to be faced with a gas tight requirement. Assuming the crew and their initial on-scene commanders were trained in making the correct assessment, they would still have to wait for specialist equipment to be brought on. This delay could in itself be critical and possibly lead to loss of life or escalation of the incident.

To commit wearers in the incorrect suit in this circumstance would be inappropriate as the risk would generally be unacceptable, thus the generic risk assessment processes dictate that an alternative approach must be identified and selected.

Beyond the simple practicality of which type of CPC to carry on pumping appliances, there is a much more fundamental question which must be addressed. If more than one type of CPC is to be available for deployment then the personnel charged with conducting and commanding any such operation and the CPC wearers must be adequately trained in the use of each type. It could be argued that this isn't so onerous but when considered in detail the reality is somewhat more complex.

Training requirements fall into a number of areas; firstly, if initial attending crews were to be required to act prior to the attendance of a specialist, such as the Hazmat Adviser, then the crew or Watch Commander would have to be trained in assessing what type of CPC is appropriate for the hazardous material involved in the incident. Whilst not wishing to diminish the ability of any responders, the UK FRS investment in hazmat training at this level is generally not what it could be and therefore the potentials of misjudgement are ever present. Indeed, even with the best of training, a missing or incorrect piece of information could lead to an inappropriate choice.

Secondly, a different approach would have to be taken for decontamination and disrobe procedures. Essentially the main difference would arise from the fact that the BA set is carried on the exterior of a Level B suit, whereas in a Level A coverall suit the set remains completely isolated from any possible contact with the hazardous material. Consequently the extrication of the wearer from a Level B suit needs to be much more controlled to ensure that there is no respiratory risk from residual contaminant when the BA face mask is removed. Regardless of the design of the level B suit, the face mask normally has to be removed, albeit as the last act, at the same time as the suit. This is not the case with a Level A coverall suit. Beyond the direct training complexities there will be additional management matters to contend with, if both types of CPC are operated in an FRS then separate and perhaps costly testing, maintenance and management procedures will have to be in place.

Finally there is the question of the remediation of the BA set. If worn with a coverall suit the set is simply cleaned and tested and put back in service. But when worn on the exterior of the level B suit there is potential for contamination, and thus the need to consider the complications and costs that this could impose.

Therefore, for all of the above reasons, most FRSs have settled on the use of the coverall Level A suit ('gas-tight' Type 1a, as described in BS EN 943) as the standard level of chemical protective clothing. For senior managers in the service this is probably a sensible choice, particularly in this day and age when we consider the potentials for litigation when things go wrong. With the coverall level A suit, a manager can be confident that no matter what the circumstance, any deployed firefighter will be protected to the maximum level and any potential for making the wrong choice is completely removed, and thus job done.

Or is it?

All of the above is reasonable but where we expect greater degrees of skill to be exercised in the delivery of specific hazmat responses, we should be able to vary the approach. In recent years we have seen an increase in the use of specialist teams for certain types of responses to hazmat incidents, but these teams have been constrained in the type of CPC provided to them, mainly using the general coverall Level A suit. These teams, however, are much more likely to be better trained and practiced and therefore better able to make reasoned and appropriate judgments about the type of protection to be worn. Notwithstanding the argument that alternatives should be available to these teams, it is also worth considering the appropriateness of the current design of the coverall suit when these personnel are required to wear Level A protection. In order to look at this we should first look at the possible types of work to be undertaken.

In a typical hazmat response, if there is such a concept, it would be likely that relatively simple tasks were to be undertaken, such as performing a rescue, gathering information, containment by laying absorbent etc. On many deployments however, more complex tasks are being undertaken by these teams and often in much more confined spaces. For instance, a deployed team may be investigating or making safe a chemical suicide scene or an illicit laboratory environment. They could be undertaking a scene assessment using sophisticated analytical equipment to determine the hazardous material involved in a spillage or deliberate attack. In such circumstances, the specialist team requires, and indeed deserves, the best protection commensurate with the risk but also the best designed suit to enable them to undertake their task without unnecessary hindrance. The coverall suit has a number of drawbacks that make close quarter or more sophisticated tasks very difficult to achieve. Firstly, vision can be severely impaired. BS EN 943-1 & 2:2002 (standard for protective clothing / performance requirements for ventilated and non-ventilated 'gas-tight' and 'non-gas-tight' chemical protective suits) set the standard for the coverall level A suit and vision distortion from the visor is included. Even though a particular design may meet the criteria laid down, the reality of operational use is that vision can be a significant problem. In cold conditions, no matter what precautions are taken by the use of de-misting agents etc., condensation from exhaled breath on the inside of the visor or the exterior of the BA facemask is a constant annoyance and distraction, requiring the wearer to remove an arm from the suit sleeve to wipe away the moisture. In addition, having the two layers of the BA, facemask and the suit visor, means that it is often difficult to get close enough to see small amounts of material, which may be required when carrying out hot zone analysis work.

Because the wearer of a coverall suit has to have the ability to withdraw their arm from the sleeve (to read a BA set gauge, operate communications equipment, wipe the visor/BA mask etc.), the suit has to have a 'batwing' design, which necessarily adds to the suit size and bulk. This in turn increases the volume of the suit and adds to the difficulties posed by inflation during use. If working in wide open spaces this may not be a problem, but place the wearer in the confines of an illicit lab set up in a domestic property and the effect can be extremely problematic. A further complication caused by the combination of this need to withdraw the arm from the sleeve and the suit inflation, is that the empty and inflated sleeve can become a rigid flail that has the potential to cause untold damage if the wearer moves inappropriately. Continuing on the sleeve issue, the wearer has to have a loose fitting glove to enable withdrawal of the arm from the sleeve. This generally means that the glove is quite bulky and therefore limits the dexterity and feel provided to the wearer. If using sampling equipment such as spatulas, tweezers or pipettes etc., or collecting very small samples, say for the use of biological field testing, the wearer is again faced with a significant obstacle.

A fundamental part of team working is the ability to communicate effectively. The coverall suit wearer faces difficulties posed by simple person to person communication, caused once again by the bulk of the suit from inflation and the simple screening effect of having a layer of material covering the speech diaphragm of one wearer and the ears of the other. Talking to a colleague who is dressed in the same suit is extremely difficult unless some form of radio communication is provided. If a personal radio is used then the likelihood is that any chat between partners can be heard by others, unless a secure frequency is used. Even if secure transmissions were possible, normal conversation is frowned upon, because unless channel switching can be easily achieved, Command, BA control or other transmissions can be interrupted or can interrupt the conversation. In the event of this it is possible for an important piece of information to be missed or misunderstood with possible dangerous consequences.

Finally, the coverall suit by its very design never fits the wearer very well despite being provided in a variety of sizes (usually governed by the boot size). Sizes tend to lead to fairly generous proportions to allow easy donning and doffing, but this in turn can lead to numerous folds and creases in the suit when used by most wearers. This is not helpful during decontamination as folds can hold run off or contaminant that has not been removed effectively. Conversely, decontamination is the only time when suit inflation may be helpful as it may remove some of these folds and creases.

Having said all of the above, it is not to say that all makes or types of coverall suits are badly designed, but simply that they are not practical for some of the more sophisticated hazmat tasks. BS EN 943-1 & 2:2002 considers the other two design of gas tight suit, 'gas-tight' Type 1b, and Type 1c, which involves the use of breathable air provided by an air line. The merits or otherwise of Type 1c are not discussed is this article, but Type 1a and 1b are described as follows:

– Type 1a - 'gas-tight' chemical protective suit with a breathable air supply independent of the ambient atmosphere, e.g. a self-contained open-circuit compressed air breathing apparatus, worn inside the chemical protective suit.
– Type 1b - 'gas-tight' chemical protective suit with a breathable air supply, e.g. a self-contained open-circuit compressed air breathing apparatus, worn outside the chemical protective suit.

The Type 1b suit is further subdivided in that the suit can have a BA face mask permanently bonded to the suit or one which is not. In each case various criteria are applied with regards to the potential for inward leakage limits to satisfy the 'gas tight' criteria. The details of the tests are fairly complex and involve reference to a further standard, EN 464 (the Type 1a suit is similarly tested against this standard). Given that there are other designs of gas tight suits available and the appropriate Standard, BS EN 943, can be applied, the potential for improved capability can and should be considered. As with all things, there are pros and cons, but some of the problems or difficulties associated with the coverall design can be overcome by selecting a Type 1b suit for specific specialist tasks.

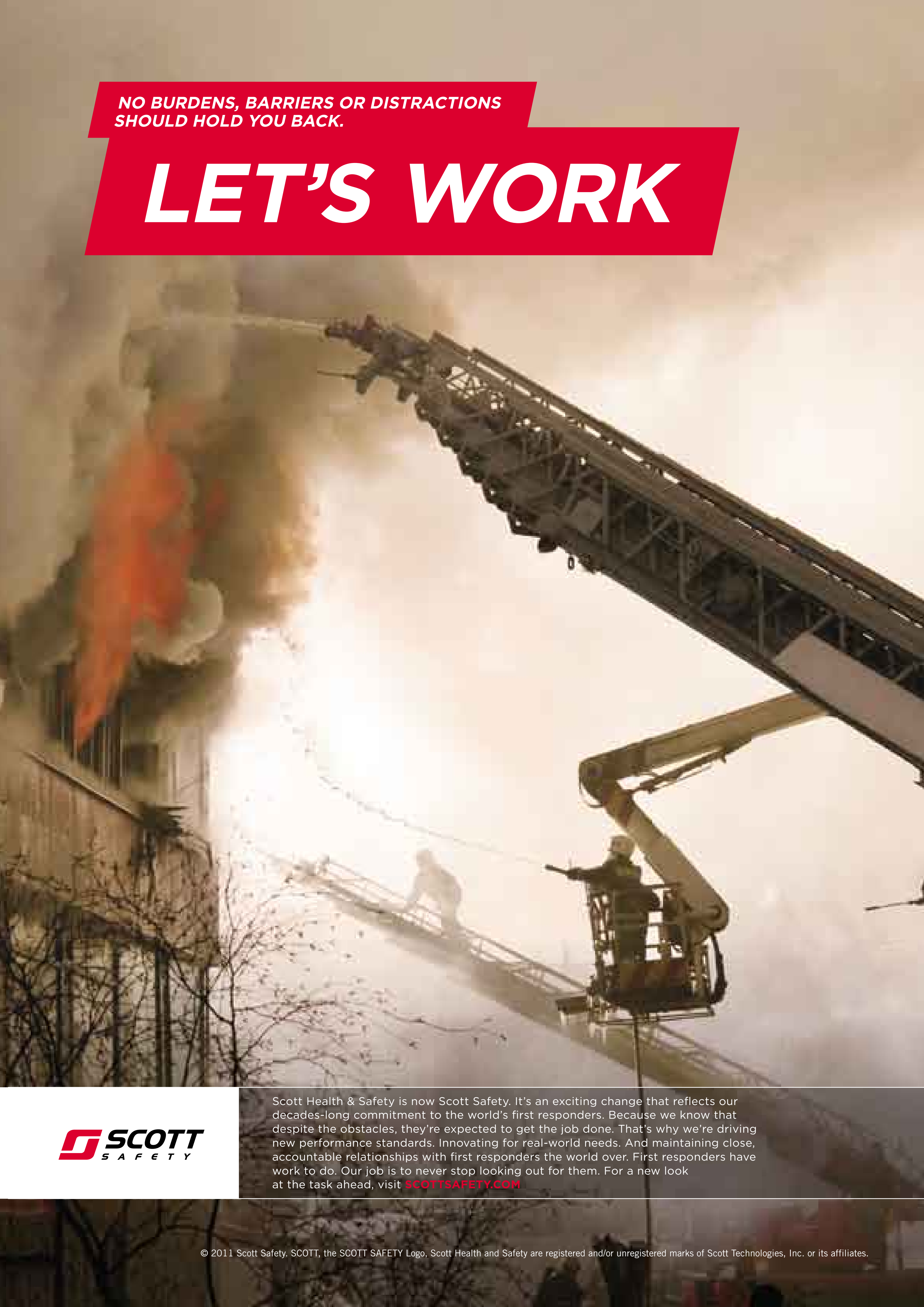
If we consider the similar issues discussed above we can now make a reasonable comparison. Firstly, the vision of the wearer can be improved as the suit's outer visor is no longer involved; the only layer the wearer has to see through is the BA face mask visor. Providing the face mask visor is maintained and not scratched, vision is never likely to be compromised, particularly through condensation. As the BA set is now worn on the outside of the suit and there is no intervening space leading to condensation, there is no need for the wearer to remove their arm from the suit sleeve. Accordingly, the suit can be closer fitting (no 'batwing' needed), the gloves can be closer fitting, giving greater dexterity and feel, and the risk from the flailing inflated sleeve is completely removed. Additionally, there is no possibility of the suit inflating to the same degree and posing any significant bulk problems when working in confined areas. Communication between wearers and anyone else is eased as all muffling effects have been removed except for the BA face mask and its speech diaphragm. Radio or other secure communications are only required for external communication and not for 'conversation' between wearers.

There are, however, some drawbacks to the Type 1b design. Unless a BA set supplementary suit feed is provided, the suit will not be positively pressured. If this positive pressure is not provided inside the suit, then any perforation to the suit material may lead to inward leakage, compromising wearer safety. This can be overcome by the provision of a feed from the BA set that allows the suit to be adequately pressurised but not over-inflated.

If the set, however, is worn on the exterior of the suit, decontamination of both the wearer and the set can occur. As a result, wearer decontamination and disrobing has to be much better practiced as BA set cleaning can pose difficulties and have cost implications. When these issues are balanced against the type of task to be undertaken, the risk of gross contamination is highly unlikely. Wearer decontamination and disrobing can be practised more routinely by specialist teams, and systems that provide high degrees of safety can be developed. In addition, many suit manufacturers provide protective shrouds for the BA set to protect against or limit contamination.

Altogether this type of design could provide considerable benefits to situations where gas tight protection is required but the work is complex or constrained. This article is not intended to demean the absolutely first class level of chemical protection provided by the various makes or design of coverall (Type 1a) gas tight suits. It is simply suggesting that the time may now be right to consider a move towards considering the use of alternative designs. Particularly in circumstances where required gas tight protection can still be provided, but those charged with more complex or involved tasks will be permitted to undertake them with better provision and support.

Disclaimer: These are the views of the author and in no way reflect the official views or policy of any agency or organisation. HRW



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Cutting the cheese

Major Christophe Libeau, Director of the Hazmat and CBRN Training Center of the Paris Fire and Rescue Brigade on their experience of a methane pocket

The intervention at the water reprocessing plant of the Parisian Agglomeration Sanitation Interdepartmental Union (in French: SIAAP) in Valenton, in the immediate southeast suburbs of Paris, on September 25, 2009, began as a classic response to a fire or an explosion. This included the use of pumps, trucks, ladders and commanding officers. Little by little, however, the findings suggested that it was an unusual operation, where the risk of an explosion was constantly present due to the presence of both methane (explosive gas), and hydrogen sulfide (toxic gas).. Therefore, the need for several officers specializing in hazmat (or technological risks), were essential and a real help to the Emergency Operations Commander (EOC or Incident command manager), particularly in risk assessment, tactical reasoning, resources anticipation, and helping public services and private companies resolve the problem. This intervention lasted three days for emergency services but about a week for the firm working to stop the leak.

What's about?! A classical intervention with great display of trucks.

Having been contacted for assistance, firemen of the , Villeneuve Street, George fire station arrived at 16:00 on the Friday. The sergeant and, chief fireman, accompanied by a site manager, discovered that the building – the outside of which was entirely non-descript and held no key to what happened inside - had been damaged by an explosion, which had destroyed the upper areas, mainly affecting a technical room, where the electrical controls of the whole installation were located. Apart the outer door of this room, which had been thrown over 100 m, (fortunately without hurting anybody), there was no visible sign of damage and no suggestion that an explosion took place.

The chief fireman then sent his team into the building on a reconnaissance, taking with them uncapped breathing apparatuses and hand-held explosimeters (Paris Fire Brigade uses MSA ALTAIR 4s). The team discovered that a further risk of explosion remained, as the explosimeter displayed low explosivity levels (LEL), ranging between 60% and 100%. This was confirmed by the company official, as even though the explosion damaged most of the facilities, only one probe, which was connected to a gas detector of combustible gas, was still working. Thus, results could be read from the outside staircase leading to technical room, displaying equally disturbing values, constantly around the 75% LEL mark.

The NCO immediately requested a "complement of regular start." The starting grid is the emergency response from the Paris Fire Brigade, from common risks to special or major ones; in this grid, the 'regular start' (or 'normal departure') is the minimum response for a fire or explosion. It consists of two pumps (or one pump and one truck and ladder). The leader of a regular start is called the 'fire guard chief,' and becomes the first emergency operations commander (EOC). When the pattern of departure warrants to send a single pump, and the chief fireman concludes that he can't manage the situation alone, he calls for a 'complement of regular start,' thereby notifying the fire guard chief. In the military organization of the Paris Fire Brigade, a fire guard chief may be either an NCO (at least a staff sergeant) or a junior officer. The chief fireman, knew that the site was a water reprocessing plant, but did not know that the building was a SESAME [SESAME, in French: Station Elevatoire de Seine Amont Extension, can be translated as an 'elevating station of upstream Seine waters'] post. The fire guard chief arrived and learnt that there was a high risk of explosion in the building, but no one was able to say what had caused the initial explosion, or the present explosive atmosphere for that matter. The chief fire guard thus requested reinforcements, seeking the support of a truck (eight firefighters) with its accompanying truck (two firefighters), a Chemical mobile unit (five firefighters), and a Chemical van from the Central Laboratory of the Prefecture of Police.

The intervention turns chemical.

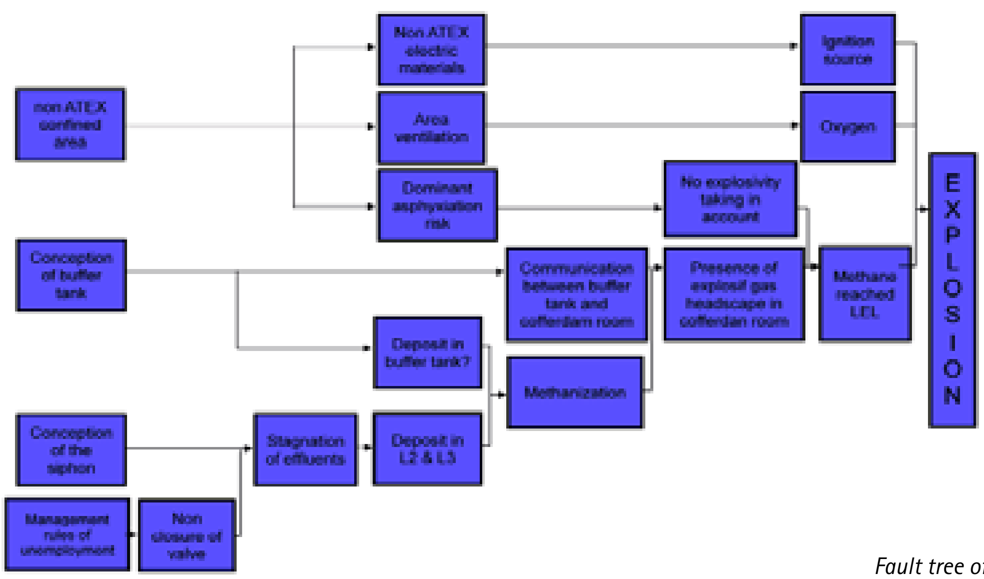
To begin, a quick overview of the support teams: The support truck and its accompanying truck is ultimately a support group dedicated to assist if there is a lack of hydrants in an area of intervention. This group is able to place a two kilometer line of pipes (or two lines of one kilometer), thus bringing water where it is needed. In this case, the only fire hydrant at the plant was unable to supply water to several pumps. In France, a chemical mobile unit generally consists of a single van, but in the Paris Fire Brigade it consists of three vehicles. These are the officer's car (as the unit head) and two vehicles responsible for responding to chemical hazards. The Central Laboratory of the Prefecture of Police is a unique organization in France. The special administrative status of Paris (in comparison with the rest of the country) makes the general police duties (normally vested by the mayor of a city), the responsibility of the Prefect of Police, an institution created by the Emperor Napoleon Bonaparte. Among the many available resources for the Prefect of Police, who reigns over Greater Paris with its 36,000 police officers, there is the Central Laboratory where much of the staff are chemical engineers. The Central Laboratory offers three main services to the EOC, being their general permanence, their explosive ordnance disposal (EOD) teams and a chemical engine. As the Paris Firefighters regularly work with the Central Lab, everyone knows each other's working methods, maintaining an effective co-operation which has endured many years.

Back to the intervention – by late afternoon, the situation was far from under control. The company engineers frankly admit that they still don't have an explanation for the origins of the explosion. They did state, however, that there was a pocket of methane in one area of the building where there it wasn't meant to be. This causes some confusion. The firefighters and company engineers also measured that the quantities of hydrogen sulfide was larger than the normal amount of production in the average process of sewage treatment in the Paris region. In response to previous requests for reinforcements, the officer of the 17th company arrived at the scene. The Company Guard Officer, a Lieutenant or Captain, is responsible for the operational activity of various fire stations that were spread all over the area of the intervention. Given the complexity of the situation, the persistence of the explosion hazard and the toxic risk, the officer decided to take command of the rescue operation. Within the Paris Fire Brigade, this act of command is official, as it shifts the responsibility to a higher-standing chief. A command post vehicle (Level Fire Group - in the Paris Fire Brigade, this group is the equivalent of a regiment in the Army. Led by a colonel, there are three fire and rescue groups, which each includes eight companies, and three other groups that have functional and non-territorial vocations: an Operational Support Group which includes most of the men and machines of various particular risks (rescue excavation, divers, cynotech, and hazmat); the School Group which brings together all the entities dedicated to initial teaching and professional training; and Supply Groups consisting of all offices and departments that provide administrative and logistic support to the 8,500 Paris firefighters) arrived at the scene, making it available to the Emergency Operations Commander. This consisted of six men and an experienced officer, including a Hazmat & CBRN Brigade technical advisor, informed by the Brigade's operational center. Due to the nature of the intervention and to the strategic importance of the site for water treatment, the senior group Guard Officer (of the 2nd Fire Group) also arrived on scene and took command of operations, after a precise and complete report of the situation.

The complexity of the situation is primarily due to the complexity of the scene.
Something which may surprise hazmat officers, is the fact that even though the building was a SESAME post, which deals with the upstream part of the rainwaters and wastewaters process, it had never been included in a risk assessment, even though the entire site was ranked as an installation for the protection of the environment. Why did this happen? Well, the description of the process of water collection simply didn't envisage any scenario where the continuously brewing waters, flowing up from a depth of minus 35 meters to a height of 3 meters by powerful lifting pumps, could produce either methane or hydrogen sulfide in such a quantity that it may create a dangerous gaseous headspace. Even the engineers were wondering how it was possible!

In addition, the building itself is a complex kind of cathedral: It is buried 35 meters below ground, with 12 meters above the earth. Furthermore, the water pumping station, lowered by gravity, does not need any human presence in normal activity, as the powerful lifting pumps provides an upward flowing action, allowing for the water brewing and settling process. It is also located at the southwestern tip of the vast site, making it well- over 800 meters from the entrance of the factory and management building. Bolstered by the presence of the water plant's engineers and technicians who remained on site, engineers and technicians of the Central Lab of the Prefecture of Police, and two officers specialized in chemical hazards, the EOC asks them to detail the systemic analysis and the study of the intervention area to better identify an effective action to eliminate any risk of explosion.

A complex systemic analysis.
To establish a systemic analysis means defining the triptych 'source + flow + targets.' The definition of flow is probably the easiest to do, measurements close to 100% of LEL in the upper parts of the SESAME post were discovered over two days; meaning that there was a full range of explosive methane (CH_4, which LEL is 5% in air and UEL is 15%) in several parts of the building. The toxic flow was less pronounced although it has crossed the 250 ppm of hydrogen sulfide (H_2S, which IDLH value (NIOSH 2003) is 100 ppm). However, there were no more sources of ignition because the electricity, cut off since the first explosion, was not restored.



Fault tree of methane explosion

Strict safety precautions were set for personnel required to perform reconnaissance. If an explosion were to occur, it could further damage the concrete structure at the top of the building, spilling concrete; especially as the expansion cone was mainly vertical due to the building being below ground. The pressure wave would also be dampened by the high embankment that surrounds the building on three sides.If we had failed to control the flow of explosives, it would still be possible to minimize its effects. Obviously, the radius of the perimeter security had been accordingly sized. The first 'a priori' perimeter, immediately fixed by first responders, had been placed 50 meters away from the debris thrown by the first explosion, identified about more than 200 meters. After the first calculations, hazmat advisor officers recommend to increase this perimeter up to about 500 meters from the center of the building, and to shelter firefighters behind walls and other buildings or, failing that, behind the trucks. Potential targets were also taken into account. The advantage of a relatively large site, located in an industrial zone, and served by few roads allowed the police to halt traffic to over a mile around the area, without any major disruptions to the overall traffic flow. Furthermore, due to the time and day of week, all the plant workers and operators were either able to leave immediately or stayed to assist in the intervention from the management building. The adjacent railways remained open, as was the connection between the service road and the main French TGV lines between the north and south of France. The command post team contacted the rail station to explain the situation and the risks involved if a certain danger threshold was overstepped, thereby giving the EOC the power to close the rail traffic if necessary.

A flexible and adaptable manoeuvre.

Even though the EOC was unable to deal with the source of the problem, he was able, with the help of his advisers, to act on the flow, and even if he still doesn't understand it had can begin to operate in various ways. His idea of manoeuvre can be formulated as follows:

"While continuously monitoring the explosimetry places, I want to reduce the volume of methane below a threshold of 5% LEL. As a first step, we need to raise the volume of water, thus reducing the volume of gas, thereby preventing leakage and adding water flow through the pipes.

The second step, the main effort, is inserting and filling the whole headspace with nitrogen.

The third step, if the second step doesn't work, consists of setting a hydraulic system with distribution of high-expansion foam, thus burying the gas volume with the foam."

The EOC did not set a time framework, as the situation was difficult to assess, but he did fix a danger limit, which was determined by experts from the Central Lab as a threshold to end emergency action. For a good part of the first night, we tried to prevent the water draining. Divers were engaged in the submerged part of the building, where they tried to replace and block the cofferdam that holds the runoff to a certain level – in water that is "less than clear!" Several attempts were made in vain, but water pressure volume didn't allow divers to take off cofferdams without supporting or reinstalling them. Thus, the EOC's major task was to substitute the volume of explosive and toxic gas with nitrogen, to inert the gas headspace. For this, Air Liquide, a major supplier of liquid nitrogen and medical gases, was contacted. At 7:00 am on Saturday the company urgently dispatched a tanker carrying 26 m3 of nitrogen. The third option, which was to use high-expansion foam, was put in place in the event of the nitrogen not working. . Due to the large volume to fill, a logistics operation was coordinated during early Friday evening to raise the hydraulic system, so it would be ready in the early hours of the morning on Saturday, September 26. Throughout the night from Friday to Saturday, firefighters and engineers from the Central Lab tracked the values of explosimetry, by combining different technology devices (catalytic and catharometric explosimeters), they also continuously updated the EOC. However, no positive trend appeared before the implementation of nitrogen inerting from 09:00.

A lengthy, but ultimately successful manoeuvre!

On the night of Saturday 26 and Sunday 27, the major effect of the manoeuvres begins to work. Since 17:00, the teams providing the records of measurements experiencing a frank and regular reduction of the percentage of LEL. Around 23:00, the results oscillated between 8% and 11%, indicating that nitrogen inerting was efficient. It must be said that in less than 24 hours, Air Liquide had emptied almost three tankers of liquid nitrogen. It was then possible to pierce the ceiling of this huge room with tools that were unlikely to cause an explosion. Some ventilation openings were also briefly created with explosion-proof forced air extraction fans. The methane was thus removed and the final explosimetry threshold reduced to values around 5% LEL. Once the EOC was sure that the situation had stabilized, he released most of the actors, public stakeholders and assistance staff who had been 'on deck' for over 24 hours, putting in place a streamlined and reduced monitoring for the rest of the night. This intervention, which was relatively atypical in all chemical interventions of the Paris region, has shown the benefits of a tight collaboration between two Parisian utilities. It further showed the benefit of having experienced hazmat specialist officers who are trained in tactical reasoning, and able to apply their knowledge to such situations.

This intervention occurred at a facility that is absolutely vital to over six million Parisians, and the importance was obvious, as not only did the Major General command the Brigade attend during the first night, and then his deputy on the second day, but the Prefect of the department and the Mayor of the city were also involved. An aggravation of the situation would have amplified the damage, as it already caused a shutdown of this strategic regional facility. Finally, in the days that followed the end of the intervention, the engineers provided a plausible explanation of the phenomenon, formulated in the fault tree on page 36: HRW

I drove all night...

Michael Logan, of the Queensland Fire and Rescue Scientific Branch, on the tyranny of distance – delivering hazmat emergency management capability within Queensland, Australia

Delivering hazardous materials (hazmat) emergency response capability within city limits is a common issue confronting many fire services across the world. But imagine delivering these services across an area that is more than two times larger than Texas or three times bigger than France! This is the reality confronting the Queensland Fire and Rescue Service (QFRS) on a daily basis. In the following sections we will highlight some of the challenges and approaches adopted by the QFRS to overcome these challenges.

The first challenge is to understand the geography and hazards within the response area, as well as the dynamics driving industrial development. Along with how the materials are used, stored and transported.

The majority of Queensland's 4.5 million population lives within the South East Corner (an area about 22,000 kilometre^2, or approximately one tenth 1/10 the size of Great Britain), major population centres (more than 50,000 persons) are dispersed across more than 1.6 million kilometre^2 and up to 1600 kilometres from the South East Corner mostly along the coast. Queensland is home to one of the largest global manufacturers of sodium cyanide, and large extractive industries such as coal. The development of the liquefied natural gas industry using methane extracted from coals seams, is also gathering momentum. Queensland is also a manufacturer and user of hazardous materials such as explosives like ammonium nitrate, pesticides, flammable liquids/gases, and toxic gases like ammonia.

Consequently, road, rail and maritime transport of hazardous materials are the

most common methods of moving these materials across Queensland, including road vehicles known as road trains. These are vehicles with two (B-double), three or more articulated trailers, as it is not uncommon for a single vehicle to transport more than 140,000 litres of petrol or diesel.

Queensland is also prone to natural events such as cyclones or floods and their impacts can be enormous – recently, floods covered an area bigger than Germany and France combined. These events also affect the QFRS preparation for and response to emergencies, including hazmat incidents such as damaged facilities, washed away containers including isotainers, or liquefied propane gas bullets deposited as a result of receding flood waters, spillages, or reactions involving large quantities of water reactive chemicals.

The second challenge is to understand what incidents typically occur and when, and where and what likely future incidents will be. From a Queensland perspective the most common incidents involve small volumes of flammable or corrosive liquids and gases usually when in transit by road. Unfortunately, large incidents involving spillages or fires generating toxic combustion products are also all too common. Recent examples include a roll-over involving a B–double road tanker carrying 50,000 litres of concentrated sulphuric acid. Fortunately very little product was lost, but the product had to be transferred before the truck could be righted. Another B–double road tanker loaded with 34 tonnes of anhydrous ammonia lost the back trailer, which then ruptured whilst settling in the roadside scrub. It occurred on an isolated rural road, but adjacent to a large coal mine where mining disruption costs more than $1 million an hour. The mine assisted in constructing a temporary road to enable the product to be removed and the trailer recovered. There are also the ubiquitous chemical fires involving warehouses and factories near large population centres and sensitive environmental areas. These incidents remind all fire services that they need to ensure that they are prepared to manage what might happen, not what they would like to happen...

Who are the QFRS? Queensland has a single state based fire service comprising a mixture of volunteer firefighters (rural firefighters), auxiliary (part-time), and permanent firefighters supported by specialists. The QFRS operates from more than 686 urban and rural fire stations with more than 1400 vehicles across the state. Wherever the incident, the QFRS can usually provide a rapid response, albeit it might take more time in some very remote locations, as well as bringing in personnel and other resources from across Queensland as needed, whether by road, sea or air. It responds to fires, rescues, natural disasters, hazmat incidents and other emergencies. Of significance to the operational response to hazmat incidents is the support provided by the Scientific Branch through a 24/7 reach–back arrangement incorporating a volunteer network across regional Queensland. It comprises of approximately 45 scientific volunteers and seven permanent scientific officers. These officers are university educated, usually chemists or engineers with extensive industrial hazardous materials management expertise. The volunteers are drawn from industry and government agencies and are an excellent example of a community service partnership between industry and the fire service. The Branch includes officers trained to undertake activities within hazardous areas, technical resources and expert knowledge about hazardous materials (behaviour and hazards, processes, containers etc.), as well as hazard prediction, advanced sampling, detection and identification capabilities.

Like all fire services, the QFRS is subject to intense community scrutiny. It is responsive to community needs/expectations and has to ensure it manages incidents effectively, efficiently and safely - no matter where they occur across Queensland.

The underpinning of any successful approach to meet these challenges is doctrine. What is your business and how do you undertake your business? This is described in our doctrine. Doctrine and its application is reflected in education/training and the resources used across Queensland. Using our knowledge of our hazards, geography and the incidents that occur, the QFRS uses a cascaded approach to providing resources, education/training, and support across the state to provide our capability and capacity. All the elements are intricately linked to ensure the required capabilities are operationally available 24 hours a day. This approach aims to have the right people and resources in the right place for the right incident type across Queensland.

The education strategy element reinforces the need to define the problem using a simple and consistent approach: product, container, environment and situation; so the incident context/consequences and impacts are appreciated. Moreover, it enables confidence about the basis for selecting the most appropriate risk control measures. QFRS courses range from basic hazmat emergency management to air detection courses, and

B Double road trains pose enormous challenges when the distances in Queensland are considered ©M. Logan

advanced courses like the Scientific Advisor program. An annual hazmat enhancement program is provided to selected areas across Queensland to continually build on the existing firefighter knowledge. The courses are integrated, taking advantage of the extensive expertise and knowledge of the Scientific Branch.

To illustrate the resource element of the QFRS capability let's consider air detection and monitoring through a cascaded distribution model. At the most basic level there are more than 500 four gas instruments deployed across the QFRS. Building on the basic level are standardised detection kits (caches), which include a mixture of wet chemistry and electronic detection and identification equipment such as photo-ionisation detectors, radiation survey meters and dosimeters, as well as items like pH paper and colorimetric tubes. Whilst further detection/ identification capability is provided at specific locations and utilises the expertise of the scientific volunteers, which may include chemical identification kits and field portable infrared spectrometers, further caches and more sophisticated detection/identification equipment are available on a state basis. The kits and equipment are designed so they can be moved to any incident across Queensland to build the detection capability and capacity at the incident, and the firefighters are familiar with the operational doctrine and use of the equipment. Their use is supported by the Scientific Branch either on-site or by reach-back arrangements.

Whilst the approach sounds impressive, it is more impressive still to consider the thinking that underpins the selection, use, maintenance and enhancements of the resources provided to firefighters across Queensland and how they link to doctrine, personnel and education. Examples of improving the resources include the recent introduction into service of more than 4500 air purifying respirators to support the use of self container breathing apparatus (SCBA), as well as new operational support vehicles incorporating a modular design so the right resources can respond to any incident. This includes air cascade systems incorporating an air compressor that can be removed and flown directly to an incident many hundreds of kilometres away. Let's use an actual example to illustrate the tyranny of distance and the success of the QFRS approaches. About 800 kilometres inland west of Brisbane, a truck carrying about 30 tonnes of pesticides rolled off the road. It overturned, immediately crushing and rupturing many containers alongside the road. Unfortunately there were more than 1200 manifested items on the vehicle which were being moved to Sydney, and their identity confirmed and subsequently destroyed. The incident occurred inside Queensland about 30 kilometres north of the Queensland-New South Wales border, and the nearest fire station was about 80 kilometres away staffed by part-time community firefighters. This station responded and a fire appliance from the nearest New South Wales fire station was also mobilised - the nearest permanently staffed fire station is about 700 kilometres to the east.

This incident aptly demonstrates the difficulties of managing a hazmat incident within remote areas of Queensland. Generally, the four critical limitations that affect resolving the emergency excluding time are personnel, resources-mitigation and detection, chemical protective clothing and respiratory protection including air supply. The initial information about the true nature of the incident was sparse at best. The incident controller used reach-back to the Scientific Branch to assist defining the incident, and to provide guidance to effectively isolate and confine the extent of any spillages identified within the limitations of the resources available. Support was mobilised and sent to the incident whilst these activities were implemented.

The QFRS region sent resources by road and air to the incident. The initial specialist resources were sent by air from 700 kilometres away and included firefighters, a scientific volunteer advisor, personal protective clothing and detection/identification equipment. Further support was sourced directly from Brisbane (800 kilometres east) by air and road. It included specialist firefighters and a scientific officer with detection equipment, as well as a specialist vehicle to provide respiratory protection including SCBA and air purifying respirators, personal protective clothing, mitigation resources and more detection equipment. An 800 kilometre drive! The provision of air on site is important since it was more than a 180 kilometre round trip to replace any used SCBAs, which clearly is a significant hindrance to any activity being successful. To provide further context about how far away the incident really was, a suitable crane to assist righting the truck was located about 8 hours drive from the incident. Clearly, the initial activities were going to focus on understanding the nature of the incident, minimising the impact of the incident on the environment, isolating the site, identifying what was involved - products and containers, keeping all responders safe, and preparing a plan to effectively resolve the incident given the time it would take resources to arrive.

As a result of the location, it took a few days for the incident to be safely resolved and incident control passed onto the recovery agencies to finally clean up the site. Activities within the hazardous area were only undertaken during daylight and the site was secured at night. The recovery of the site and vehicle removal took a few weeks.

In summation, The QFRS has an integrated approach to overcome the tyranny of distance to provide a hazmat emergency management capability across Queensland. The approach incorporates many elements including risk assessment underpinned by doctrine, education, and uses an understanding of the incident types, hazards, geography and population. The approach also ensures the QFRS is responsive and reflects the community needs and expectations. It is a never-ending journey and a story that shows the QFRS is better prepared today, than yesterday, and will be better prepared tomorrow to safely, effectively and efficiently manage any hazmat incident that may occur within Queensland. **HRW**

Queensland has a mix of volunteer, auxiliary and permanent fire fighters ©M. Logan

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Radiation Detection in the face of disaster

Steve Johnson looks at some of the early lessons learned from Fukushima Daiichi

Events have a habit of overtaking the slower pace of policy and article composition. In the light of the multiple disasters afflicting Japan it would remiss to present an article on radiation detection without looking at the very unique challenges that are being faced today. HazMat Responder World has the utmost sympathy and compassion for the Japanese in their time of crisis and this article is a think piece about the challenges and in no way suggests any deficiency in the Japanese response.

For those who have somehow managed to miss every news report over the last month, the situation experienced in Japan is as follows: Having suffered a major earthquake Japan was further beset by a tsunami. Having one of the highest numbers of nuclear power plants in the world they utilise safeguards at all the plants to place them in 'shut down' during such an event – not an insignificant piece of safety engineering. Unfortunately the tsunami then damaged power systems that ran cooling plants for the Fukushima Daiichi nuclear plant, which led to some explosive venting of gases from reactors and releases of radioactivity.

Around about this stage the world's press went in to a feeding frenzy on an incident that was filled with stock fear phrases: radiation, plumes, meltdown, and explosions to name a few. It portrayed how little the press and some 'experts' really knew about the situation or nuclear accidents in general. A particularly annoying issue was the presenters who talked about radiation reaching Tokyo from the plants, as opposed to radioactive particles. While the Japanese authorities implemented an extremely sensible evacuation policy and contamination monitoring regime, many other foreign

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companies and agencies were panic buying anything that had 'radiation detector' painted on it.

CBRNe World was itself phoned up by a number of organisations that were distraught and trying to get hold of equipment, without knowing what they needed. What is then appropriate? Well, if you cannot avoid being within a possible area of contamination then a dosimeter to record the dose is key – and electronic personal dosimeters are excellent, although belt and braces would also further advise a Thermo Luminescent Dosimeter for later reading by a specialist lab. While this gives the wearer some level of understanding of the immediate superficial external dose, it doesn't provide much coverage of the particulate hazard...

Radiation in air monitoring has been an awkward issue for dose monitoring. While the particles may be below the threshold for detection they can accumulate in the environment, in the food chain and in the respiratory tract of the unprotected population. While time, distance and shielding works for radiation sources the dynamic nature of radiation in air (RIA) can leave you unable to move away from the source, just as one might be caught in the plume of a chemical release. Quantifying this nature of hazard can be achieved with some relatively simple solutions but requires some applied knowledge.

In terms of non-fixed contamination, if it is left to settle, then detection of contamination can be improved by concentrating it - the most simple method is a wipe (Whatman papers are popular) or a swab across a surface offered up to a radiation survey monitor (importantly the sensor should be held above the swab to ensure that contamination doesn't fall on to the face or grill), whilst a more high tech solution involves hoovers to draw the maximum amount of dust and material across a wide area but the principal remains the same. For monitoring the radioactive particles still suspended in the air some form of sampling is required. As you might expect there are fixed site, mobile and personal solutions – predominantly designed for use by the nuclear industry, i.e. not very accessible for non specialists. In all cases they concentrate particles on to a medium which can then be monitored at regular intervals for contamination; this allows estimation as a crude average of the contamination in air. More complex systems actually have a sensor aligned with the sampling paper so that they can immediately alarm if there is a sudden increase in contamination.

Personal systems tend to be purely air sampling, drawing in air at breathing rate. These then require either the sample paper or the whole device to be inserted into a monitoring system. These systems have been designed for workers to be able to monitor potential exposure during a work shift – so it is only at the end of the shift that an exposure is identified unless levels were high enough to trigger a personal dosimeter as well.

RIA is a step change from conventional radiological detection ©Falcon Comms

What then are the implications of working or operating in an environment with non-fixed radioactive particulate hazards? In the first instance, unlike with radiation fields, you cannot simply identify safe and dangerous zones. They will change, literally, with the wind and when they change you can suddenly find yourself unable to get out without moving significant distances. As such the onus is on ensuring that you have protective equipment and contamination control measures in place – full face respirators with particulate filters not only protect but can also act as sampling systems in their own right. You may even see teams on the news offering sensors up to the respirator canister as a way of monitoring exposure, and this is a necessity as otherwise you may allow a concentration of radioactive particles to accumulate close to the face.

Smooth non-porous clothing or coveralls with head covering then prevent the accumulation of particles in the weave of clothing and hair. Finally a double layer of gloves helps prevent both the spread of contamination and the ingress of particles under nails (if this sounds excessive you may wish to Google some of the injuries that have been caused by workers who lost fingers due to particles trapped under nail beds). The double layer allows for the regular replacement of the outer layer to prevent accumulation of contamination without exposing the skin.

While this hopefully gives some insight in to the precautions that should be considered in these situations, Japan is already starting to face the secondary effects. Accumulation of radioactivity in the food chain and water supplies requires close monitoring, although levels at the time of writing are not particularly significant. Bio-accumulators in nature though can be sources of concern, just as other heavy metals have caused concern when they enter the food chain.

The challenge of managing this scale of event and fear has led to a huge surge in purchasing sensors, some of which may well have been unnecessary. In the face of this, rumours surfaced that industry implemented a triage system to ensure that urgent requirements were discriminated from 'worried well' purchases. It does suggest fragility in the capacity of the radiation equipment industry and the fine tolerances at which it operates. It took less than a week for all UK equipment to empty off the shelves, and detectors that require more specialist crystals (CT and CZT for example) have long led supply shortages even in periods of average demand. Despite some press and lobbying to the contrary, global nuclear builds are unlikely to be majorly delayed – as such the Japanese experience should hopefully be sending a message to countries with build programmes to ensure that they factor in procurement of enough sensors to deal with emergency scenarios. The Japanese had fortuitously only recently conducted an exercise looking at radiological response and others may want to check that they are as well prepared. **HRW**

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Making Sense of the Numbers in Radiation Events

By Rick Whitman, Adjunct Lecturer for Homeland Security, School of Technology, Purdue University

Over the years, whenever I hear radiation safety being taught, just as the instructor mentions, "time, distance and shielding," you can almost hear the sound of eyelids slamming shut, and those still awake often mutter something like, "Oh no, not this again....." However they might like to ignore it, this information helps in a radiation emergency. If you are a trainer, or if you make decisions about sending first responders or others into harm's way, this article covers the questions others will ask, for which you want to have good answers and the confidence to know what it all means. The emphasis on both units of radiation and units of time are a part of time, distance and shielding.

Errors and misunderstandings often appear at awkward moments when good intentions are defeated, resulting in illogical conclusions. Consider this; Paul and John are first responders who answer a call to rescue someone in a radiation emergency. Paul operates a radiation meter and determines that in the one minute it took them to free a victim and get out of the area, the meter saw a high reading of 1.8 milliGray/hour. A local health official at the scene debriefs Paul and records "1.8 milliGray of radiation exposure" for Paul and John. But was it really 1.8 milliGray? And how bad is 1.8 milliGray anyway? Is it enough to cause a health concern? In the above scenario, the well intentioned health official should have asked how long Paul and John were in the radiation area. Since there are 60 minutes in an hour, the actual exposure that Paul and John received would only be part of 1.8 milliGray as they were only in the radiation area for one minute. Mathematically this works out to:1/60 hour x 1.8 milliGray/hour = .03 milliGray, which is far less exposure than 1.8 milligray.

In order to get the most from this article, several similar and dissimilar terms need spotlighting. One is the type of meter, another is the output from the meter, and the last is the time consideration. The output value is vital in interpreting potential effects. Several types of meters and their characteristics are shown in table 1.

Before we continue about meters, a word about time is in order. Ideally, meters used by first responders will read out in units per hour. If you or someone on your staff goes into a room for 10 minutes and his meter shows a constant reading of 2 Grays per hour, several factors of consideration are needed to interpret the effect of this reading. Since 10 minutes is 1/6th of an hour, the real exposure illustrated here is 1/6 x 2 = .33 Gray, significantly less than 2 Grays accumulated exposure.

For simplicity reasons, this next section presumes that all the radiation readings are for one hour, so that we can focus on prefixes. Outputs can be confusing, as if misinterpreted at a response site the difference could result in a high exposure. Care with reading the prefixes require special emphasis when training so that correct values are used for judgements about safety. A common error is to mix 'm' and 'u' as the same, when there is a 1000x difference between these units. Table 2 contains a chart of prefixes.

The first of these is the reading or output from nearly any radiation meter. Radiation meters, however, do have several names, different ways of working, and varying readouts. Some require different settings, such as x0.1 or x1 or x10 and a keen eye to interpolate the meter reading. Other meters are self-ranging, which means the meter senses the amount of radiation being received and presents a value without operator actions. One type of meter, which exists in both the dial setting and the self-ranging form, is called the Geiger-Muller Meter or more commonly a Geiger Counter, which is the most common type of radiation meter amongst first responders. For safety in the first responder community, meters which

Meter	Output	Comments
Geiger-Muller, with operator dial settings	Counts per second	Not a first choice for first responders.
Geiger-Muller, self-ranging	Grays (or sub-units)/hr (SI -World) rads (or sub-units)/hr (US)	Ideal for first responders - BUT – values between equal units are 1:100, e.g. 1Gray/hr = 100rad/hr.
Ion Chamber Meter with operator dial	Grays (or sub-units/hr (SI – World) rads (or sub-units)/hr (US)	Larger and less durable for emergency work, e.g. fire or damaged area. Same advice on values as above.
Scintillation Meter, Self-ranging	Grays (or sub-units/hr (SI – World) rads (or sub-units)/hr (US)	Good choice for first responders but less durable than Geiger-Muller meters.

Table 1

read in Grays/hour, Centi or milliGray/hour or even in microGray/hour are common in most of the world. In the United States, many meters still provide readings in rads/hour, millirads/hour or microrads/hour. Two cautions are advised: Firstly, meters with outputs in 'counts/second' should not be used by first responders. Secondly, if meters using any kind of Grays/hour are in use with meters whose outputs read in units of rads/hour, take care to ensure that the units equate. Many of the same prefixed Grays and rads have a 1 Gray to 100 rad equivalence, so the chance for large error can occur, especially during an emergency response at night and in bad weather!

In order to make certain points, consider the next several illustrative examples. Although they are highly unlikely, they will serve to create scenarios to which responses can be developed, explained and critiqued.

Unlikely Scenario 1: An oxygen tank has exploded and causes damage at a hospital close to you. You and your colleagues are directed to rescue a patient, a doctor and a technologist who are still in a radiology suite which uses an electrically generated beam to reduce cancer tumours. You and two others are sent to the area and directed to take a radiation meter with you, where you discover that the radiation beam is on but all three victims are away from the direct beam. In the time it takes to free debris from the door and get the victims out, your meter reads 2.8 Gray/hour for a total of 5 minutes. Your exposure would have been:

5 minutes/1 x 60 minutes/hour x 2.8 Gray/hour = .233 Gray (which is the same as 233 milliGray). Note: This kind of electrically generated beam can be eliminated by cutting the power, with no residual effect.

Unlikely Scenario 2: A nuclear gauge for an industrial plant is being transported on a highway. A snow storm begins and the transport vehicle skids off the highway, rolls down an embankment and onto another highway, where the gauge breaks its tie down chains and is then hit by several other vehicles. The driver's manifest discloses that the gauge contains a large quantity of Cesium-137. You are called to respond and again a meter is used. Others are directed to rescue people from vehicles, whilst you are directed to find the gauge. Your meter is showing units in the low uGy/hr range and you finally find the gauge and obtain readings in the low mGy/hr on contact and low uGy/hr at arm's length. It is likely that you have found the source, but will need the help of others to confirm it. Gauges will misshape during this kind of mishap, making it more likely that the source is well within the gauge. Your exposure in this scenario is miniscule as you are not near the source for more than a few seconds.

Unlikely Scenario 3: A graduate student is performing an experiment using radioactive material at a nearby university. She is carrying a flask with a litre of liquid and radioactive materials, when the flask slips out of her hands and breaks in a hallway. You are called to assist the university radiation protection staff and determine if the radiation has been tracked elsewhere. As you arrive you turn on your meter and take a local background reading, which you find to be .010 uGray/hour. While near the site of the accident, you read 60 uGy/hr, but you are there less than one minute. Your actual exposure would have been:

1/60 hr x 60 uGy/hr = 1 uGy

Regardless of your experience, there are some things which good trainers should tell you to add to your arsenal. These include how to interpret radiation meter data so as to be sure how much hazard you or your colleagues have been exposed to and what these numbers represent. Best protection comes from minimizing your exposure time, using extra distance or using extra shielding.

Actual interpretation of health effects would occur at much higher values than those discussed here and will necessitate the assistance of a health physicist to ensure correct interpretations were made. Since some types of radiation have a higher effect than gamma or x-ray discussed here, you need to provide your physicist with any information you have. **HRW**

Unit	Abbreviation on Meter	Discussion
Gray (or rad) [the whole unit]	Gy or rad Note: some will use R	1 Gray = 100 rads
CentiGray [1/100th of a Gray]	cGy	1 cGy = 1 rad - the SI/World and US Units convert directly here.
milliGray (or millirad) [1/1000 of a Gray or a rad]	mGy (or mrad)	1 mGy = 100 mrad
microGray (or microrad) [1,000,000 of a Gray or rad]	uGy (or urad)	1 uGy = 100 urad

Table 2

Active Dosimeters

	Direct-Reading (1)	DMC2000S (2)	DMC2000X (3)	DMC2000XB (4)	DMC2000GN (5)	SOR/T (6)	SOR/R (7)	SOR/RF (8)	RAD 60 (9)	DOSE-GARD (10)
Size of product (Height, Width, Depth in cm)	12.4 x 1.5	8.4 x 4.8 x 1.75	8.4 x 4.8 x 1.75	8.4 x 4.8 x 1.75	8.7 x 4.8 x 2.1	8 x 4.8 x 0.9	8 x 4.8 x 0.9	8 x 4.8 x 0.9	7.8 x 6.7 x 2.2	3.81 x 1.91
Weight (grammes)	25g	56g	58g	58g	80g	55g	55g	55g	80g	46g
Op temperature range	-20c to 50c	-10c to 50c	-10c to 50c	-10c to 50c	-10c to 50c	-40c to 50c	-20c to 50c	-20c to 50c	-20c to 50c	-30c to 71c
Technology utilised	Ion Chamber	Silicon detector	Silicon detector	Silicon detector	Silicon detector	Silicon detector	Silicon detector	Silicon detector	Silicon detector	Ion Chamber
Types of radiation measured	Gamma, X-Ray	Gamma, X-Ray	Gamma, low X-Ray	Gamma, low X-Ray, beta	Gamma, Neutron	Residual / tactical Gamma, Neutron	Residual Gamma	Residual Gamma	Gamma, X-Ray	Gamma, X-Ray
Energy range	16 KeV to 6 MeV	50 KeV to 6 MeV	20 KeV to 6 MeV	y,X: 20 KeV to 6 MeV ß: 60KeV to 3.5 MeV	y: 50 KeV to 6 MeV n: 0.025 eV to 15 MeV	50 KeV to 6 MeV	50 KeV to 6 MeV	50 KeV to 6 MeV	50 KeV to 6 MeV	50 KeV to 6 MeV
Accumulated dose measured	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Shift dose measured	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dose rate alarm(s)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dose alarm(s)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Audible or visual alarm	No	Both	Both	Both	Both	Both	Both	Both	Both	Both
Reach-back	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Battery type / Battery life	N/A	LiMn O_2 6 months continuous	LiMn O_2 4.5 months continuous	LiMn O_2 4.5 months continuous	LiMn O_2 4.5 months continuous	LiMn O_2 6 months continuous	LiMn O_2 6 months continuous	LiMn O_2 6 months continuous	AAA 2000 hours	Lithium disk 3 years
Countries sold	Civil defence, Homeland security, Industry	Civil defence, Industry Worldwide	Civil defence, Medical Worldwide	Medical & Industry Worldwide	Industry & Defence Worldwide	NATO countries	NATO countries	Not supplied	Civil Defence & Industry	NY OEM, Penns Power, PA Dept. Env. & others

1 Arrow

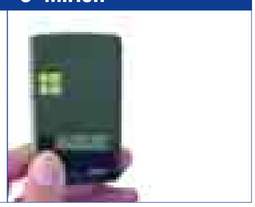
2 Mirion

3 Mirion

4 Mirion

5 Mirion

6 Mirion



7 Mirion

8 Mirion

9 Mirion

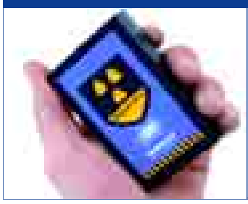
10 General Atomics

11 Canberra

12 Canberra

Ultra-Radiac (11)	AN/UDR-13 (12)	Sentry (13)	Sentry USB (14)	micro-Raider (15)	1405 (16)	1610 (17)	1703MO-1A/B (18)	1604 A/B (19)	1621 (20)	1208M (21)	1203M (22)	1603A (23)	1208 (24)
10 x 6.6 x 3.1	10 x 6.6 x 2.8	9.7 x 7 x 2.5	10.5 x 6.7 x 2.7	12.2 x 6.8 x 3	14.8 x 8.5 x 4	5.8 x 5.8 x 1.8	7.5 x 3.5 x 9.8	5 x 9 x 1.9	8.7 x 7.2 x 3.5	5.2 x 4.8 x 1.8	12.5 x 4.2 x 2.4	5 x 5.6 x 1.9	5 x 4.5 x 2
269g	270g	136g	227g	390g	290g	70g	250g	85g	150g	100g	90g	85g	95g
-30c to 61c	-51c to 50c	-20c to 50c	-20c to 50c	-20c to 50c	-10c to 50c	-20c to 50c	-30c to 50c	-20c to 70c	-40c to 60c	0c to 45c	-15c to 60c	-20c to 70c	0c to 45c
Energy compensated GM tube	Pin Diode PMOS, GM tube	Geiger Muller tube	Energy compensated GM tube	Solid state CdZnTe	Geiger Muller tube	Geiger Muller tube	CsI, Geiger Muller tube	Geiger Muller tube	Geiger Muller tube	Geiger Muller tube	Geiger Muller tube	Geiger Muller tube	Geiger Muller tube
Gamma	Gamma, Neutron	Gamma, X-Ray	Gamma, X-Ray	Gamma, Neutron	Gamma, Beta	Gamma, X-Ray	Gamma	Gamma	Gamma, X-Ray	Gamma	Gamma	Gamma	Gamma
60 KeV to 1.5 MeV	80 KeV to 3 MeV	40 KeV to 6 MeV	30 KeV to 10 MeV	50 KeV to 3 MeV	y: 50 KeV to 3 MeV ß: 100KeV to 3.5 MeV	20 KeV to 10 MeV	33 KeV to 3 MeV	48 KeV to 6 MeV	10 KeV to 2 MeV	60 KeV to 1.5 MeV	60 KeV to 1.5 MeV	48 KeV to 3 MeV	60 KeV to 1.5 MeV
Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	Yes	Yes	No	No	Yes	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Both	Both	Both	Both	Both	Both	Both	Both	Audible	Both	Both	Both	Audible	Both
No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
AAA 150 hours	AAA 150 hours	9V 1500 hours	9V 1500 hours	L-ion 20 hours	AA 6 months	Rechargeable battery 1 month	AA 1000 hours	Lithium CR2032 9 months	AA 12 months	Lithium CR2032 18 months	V357 12 months	Lithium CR2032 9 months	Lithium CR2032 12 months
First responders	NL Navy, US Civil Defence, Army: US, IT, CAN, ESP, IRL, DAN, Taiwan	Not supplied	Not supplied	RCMP, NYPD, State of Illinois	First responders, Industry	Industry & Medical	Border police and customs, First responders	Industry & Medical	First responders	Industry	Border police and customs, First responders	Border police and customs, First responders	Industry

13 SE International



14 SE International

15 ICx

16 Polimaster

17 Polimaster

18 Polimaster

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21 Polimaster

22 Polimaster

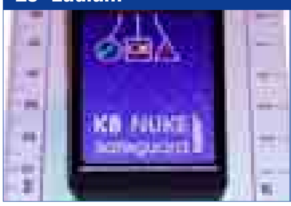
23 Polimaster

24 Polimaster

Active Dosimeters

	K8 (25)	Model 25 (26)	MiniTrace Gamma (27)	Gamma i (28)	EPD N (29)	EPD Mk 2 (30)	EPD Mk 2+ (31)	EPD G (32)	GammaRAE II R (33)	NeutronRAE II (34)
Size of product (Height, Width, Depth in cm)	3.9 x 2.5 x 1.2	7.6 x 5.4 x 1.7	1.3 x 8.2 x 2.4	9.8 x 6.9 x 2.5	8.6 x 6.3 x 1.85	8.5 x 6.3 x 1.9	8.5 x 6.3 x 1.9	8.5 x 6.3 x 1.9	12.5 x 6.8 x 3.5	12.5 x 6.8 x 3.5
Weight (grammes)	13g	145g	175g	145g	108g	95g	95g	95g	270g	283g
Op temperature range	-10c to 45c	-40c to 65c	-10c to 50c	-25c to 50c	-10c to 40c	-10c to 40c	-10c to 50c	-10c to 50c	-20c to 50c	-20c to 50c
Technology utilised	Solid state	Energy compensated GM tube	Geiger Muller tube	Si Diode, Energy comp, isotropic	Multi detector	Multi detector	Multi detector	Multi detector	Pin Diode CsI (TI)	3cc CsI (TI) photodiode, 1cc LiI (EU)
Types of radiation measured	Gamma	Gamma	Gamma	Gamma, X-Ray, Beta	Gamma, Neutron X-Ray	Gamma, Beta X-Ray	Gamma, Beta X-Ray	Gamma, X-Ray	Gamma	Gamma, Neutron
Energy range	20 KeV to 10 MeV	16 KeV to 2 MeV	48 KeV to 3 MeV	y: 50 KeV to 6 MeV ß: >2 MeV	n: 0.025 eV to 15 MeV photon: 20 KeV to 10 MeV	15 KeV to 10 MeV	15 KeV to 10 MeV	15 KeV to 10 MeV	6 KeV to 3 MeV	y: 6 KeV to 3 MeV n: to 14 MeV
Accumulated dose measured	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Shift dose measured	No	No	Not Supplied	Not Supplied	Yes	Yes	Yes	Yes	Yes	Yes
Dose rate alarm(s)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dose alarm(s)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Audible or visual alarm	Both	Both	Both	Both	Both	Both	Both	Both	Both	Both
Reach-back	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Battery type / Battery life	Lithium CR2032 1500 hours	Lithium 6000 hours	AA 2000 hours	AA 4000 hours	AA 42 days	AA 30 weeks	AA 45 days	AA 45 days	AA 900 hours	AA 900 hours
Countries sold	First responders	First responders	Homeland Security, Emergency ministries, Industry in DEU, FRA, RUS, UKR, PRC, IND	Not supplied	Not supplied	USN, Army: DEN, AUT, UK. First responders: UK	Not supplied	Not supplied	First responders	Military & First responders

25 Ludlum



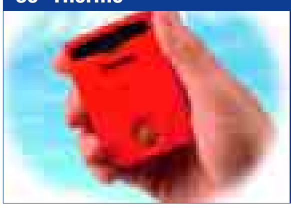
26 Ludlum

27 Saphymo

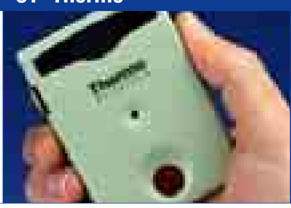
28 Saphymo

29 Thermo

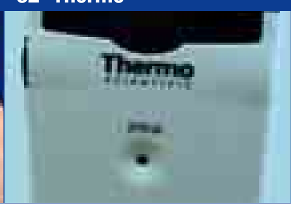
30 Thermo



31 Thermo



32 Thermo



33 RAE Systems

34 RAE Systems

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Chris Hawley and R. W. "Bob" Royall Jr.

Once again America's Hazmat Teams are facing serious challenges. This time it's not some new and exotic substance or a change in the terrorism threat perspective. This time the forces are coming from within and may very well threaten the very survival of some teams. The current fiscal climate coupled with how fire departments are re-inventing themselves is being heavily influenced by local governmental decisions of how to do more with less. Philosopher, George Santayana who is often miss-quoted said, "Those who cannot remember the past are condemned to repeat it." Hopefully the echo of these words will be heard as local governments contemplate the future of Special Operations Teams.

Formal hazardous materials response in the United States is relatively young with the first dedicated Team established in 1977 in Jacksonville Florida, followed by the Houston Hazmat Team in 1979. Those teams as well as many others were formed as a result of several catastrophic events involving hazardous materials. The rocky path to today has been paved with the lives of many who had no hazardous materials response training, were ill-equipped, and ill-prepared to deal with such dangers. It is our hope that the gains we have realized will not be lost in the new emerging fire service; otherwise we will be condemned to repeat the past. Over the past 34 years we have witnessed a multi-faceted evolution of how Hazmat Response Teams function, and a great topic of discussion over time has been how well "we remember the past." With regard to that past we have assembled a list of significant hazmat events, most of which took place in the United States. Bhopal, India has been included as well due to its significant regulatory impact. If you consider yourself to be a hazmat responder, it is important that you know some of the facts regarding these hazmat cities and their respective chemicals.

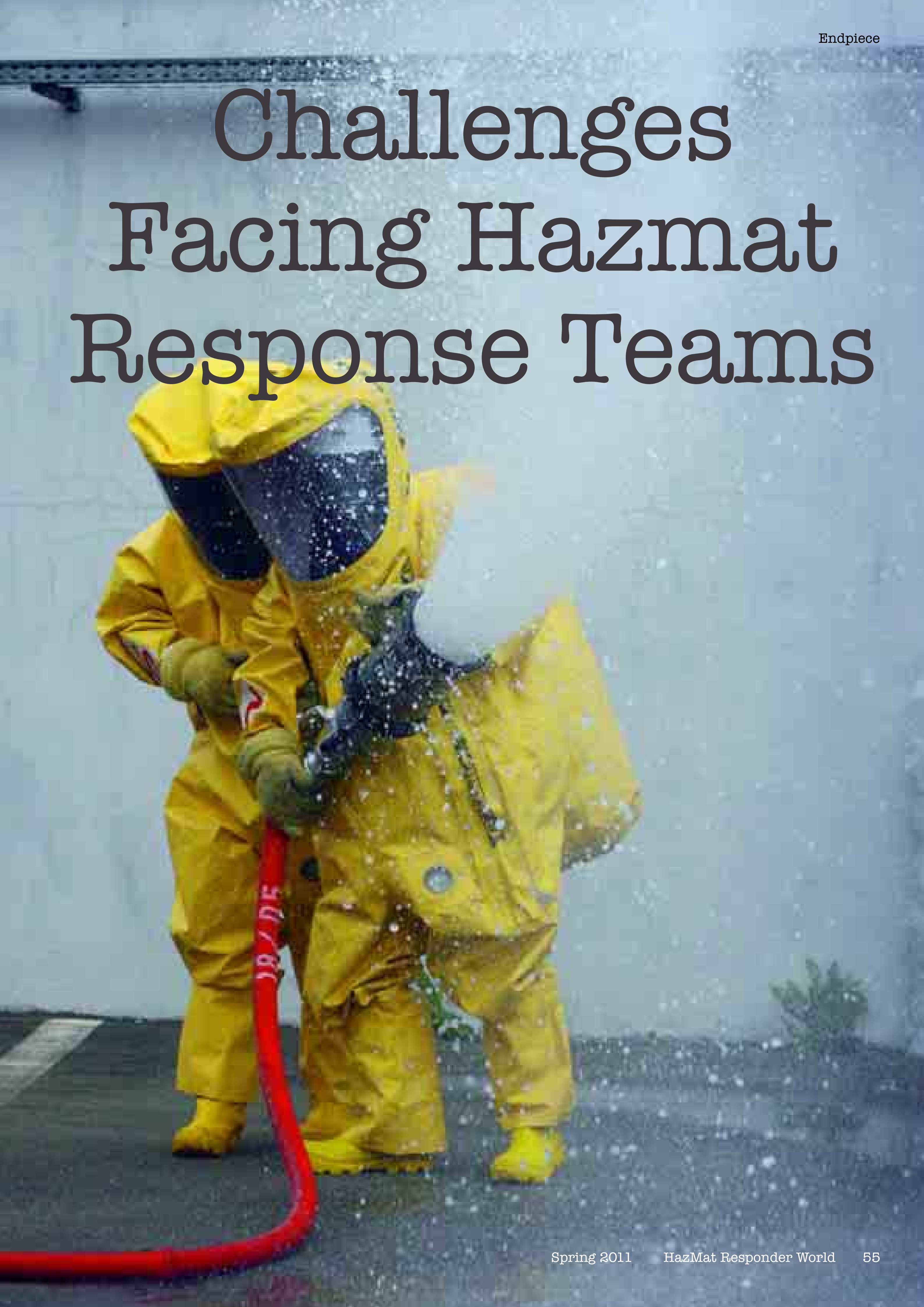
America's Hazmat Response Teams are facing some significant challenges, and unfortunately there may be more to come. In preparation for this article we queried a small, but comprehensive group of Hazmat Team leaders. This diverse group comes from varied response areas representing some of the busiest and some of the least active teams in the United States. A good cross-section was surveyed, representing full-time (dedicated) hazmat, dual function (fire/hazmat), volunteer fire service, and some state and specialized Federal teams. . All were asked the same simple question – "What do you see as the current and future challenges facing today's Hazmat Teams?"

– Budgetary/Fiscal Issues: An almost unanimous answer from our respondents dealt with budget and fiscal matters. When cities are faced with laying-off public safety personnel, closing fire companies, and making drastic budget cuts to other services, Specialty Operations units such as Hazmat Teams are often the first to be cut. Clark County, Nevada, whose response area includes a large portion of the Las Vegas Strip, recently placed their Hazmat and Heavy Rescue units out of service. Once an integral part of the protection for a sizeable population and a major tourism industry, these teams are no more, and the City of Las Vegas is now asked to provide that service. The concern is that this may become a growing trend, especially for less busy teams in communities with a low potential for large scale incidents. History has shown that catastrophic hazmat incidents are not restricted to large metropolitan areas and can happen anywhere. A safe response requires specialized training and equipment.

Reduced tax revenues coupled with decreasing grant funds are creating the budget challenge. In the years immediately following September 11th (9-11) grant money flowed like a flooded river. Now, in the absence of another large scale attack, the money flow has dwindled. Prior to 2001, most Hazmat Response Teams were significantly underfunded, underequipped, and the quality of training was an issue. Following the attacks, funding was no longer an issue, equipment (needed or not) was readily distributed, and Weapons of Mass Destruction (WMD) training was provided at an incredible pace. The focus of hazmat response, however, quickly became skewed. Agencies that shouldn't be involved suddenly were in the game. They were well equipped, well trained, and well funded without response experience and a clearly defined mission. Those teams who were in business prior to 9-11 ended up with all kinds of new equipment, but also with WMD training clouding the focus of their core mission. Some believe that if America were ever attacked again that the money would return. A topic of discussion for another day would be the appropriate division and distribution of such funding.

– Technology: The second answer from our survey group dealt with technology, which also relates to the third challenge, training. Following the Tokyo Subway attack, Murrah Building Bombing, and terrorist events of 2001, the response community clamoured for better and more advanced technologies. The manufacturers answered the call and over the past 10 years there has been a rapid progression of available technologies for hazmat response. In fact, advances have come so fast that responders often struggle to keep up with the sophistication, which leads us to an important question, "Are we better off now?" Prior to all of these new technologies a hazmat team would have used a standard four gas instrument, a photoionization detector, and colorimetric sampling tubes to identify an unknown vapour in a building. Today, teams can choose from a variety of high-end instruments, such as a Fourier Transform Infrared (FTIR) spectroscopy device to help in that identification. Although the FTIR is a much quicker and more advanced instrument, it has a slightly steeper learning curve to truly understand the instrument response. Additionally, the FTIR is limited when it comes to detecting concentrations below the 50-100 parts per million (ppm) ranges. In some cases, colorimetric tubes have much lower thresholds of detection and are fairly simple to use. Depending on the brand, a potential 'chemical of interest' can be identified by using a couple of

Challenges Facing Hazmat Response Teams



different tubes. The cost differential between FTIR and colorimetric tubes is approximately $24,000 USD. It should be inferred that we are against the use of new technologies – these devices have expanded our capabilities, but there is a cost associated with owning and maintaining them. When operated properly, the FTIR will provide a much quicker and in most cases a more accurate response, but on the other hand, colorimetric tubes usually have a lower threshold of detection and are considerably less expensive to purchase. As with any detection device though, success depends on the experience and skill level of the operator.

– Training: Another concern for hazmat responders is training. In this terrorism era, much of the hazmat training is geared towards WMD response. A lot of money, time, and energy has been spent on preparing for low frequency/ high impact events. While WMD training is an important part of the new norm, there is an ever-growing need to refocus on the basics which prepares hazmat responders in handling the high frequency/ low impact incidents. Failure to properly respond to these events can lead to a potentially high impact outcome. Just like the highly specialized technologies, a lot of today's training is based on the WMD threat perspective in order to be funded by grant dollars. Without a doubt, it is important for our hazmat responders to be trained to respond to a WMD event, but they must also be able to operate a simple multi-gas atmospheric air monitoring instrument, interpret the results, and make an informed decision. Today we find our tool box loaded with tools. Can your team use all of those tools and make a risk assessment based on their interpretation? Has your team been trained to flare a leaking propane tank? Can they use a set of colorimetric tubes to identify an unknown vapour? Can they adequately explain Lower Explosive Limit (LEL) correction factors? Can they explain photoionization or better yet, ionization which is the basis for the detection of many of the military chemical agents?

– Recruitment, Retention, and Motivation: The fourth challenge relates to the recruitment, retention, and motivation of personnel. With limited training and equipment, the early Hazmat Response Teams primarily responded to hydrocarbon spills and related incidents. As advances in protective clothing came along, hazmat teams became more specialized and in some cases they were nicknamed 'mop & glow.' Responders who were looking for a challenge were motivated to join the Hazmat Team. Later, with advances in training and equipment, more people gravitated towards these Special Operations Teams, but today attrition has taken a toll on the original group. Many have been promoted or retired, some have left the business, and others have passed on. As a result, many teams are suffering through a rough transition – some failed to recognize the obvious and didn't plan for the next phase, not allowing time for the person leaving to train their replacement. This has resulted in experienced persons leaving the group and someone with little or no training and experience quickly moving into their place. While some teams do require prerequisite training prior to an assignment, it is rare.

– The numbers of true hazmat responses are also down. Upon analysis we can attribute several factors; industry is doing a much better job in process safety of operations, positive advancements in containers construction, and improvements in responder training from 30 years ago. But fewer responses equate to less experience, making it more difficult to attract and retain highly skilled and motivated personnel. History has shown that responders gravitate towards a specialty team to become part of an elite group. But if the elite group never goes anywhere or doesn't have an opportunity to use their education and skills, boredom replaces motivation, skills deteriorate, and complacency sets in. There is a huge difference between complacency and confidence – someone who is confident has the training and experience to make appropriate decisions along with the motivation to do the right thing.

– In today's post 9-11 United States we find two major types of hazmat/WMD team response profiles. One has a primary mission and responsibility for responding to potential WMD events. The other performs a more traditional role as a Hazardous Materials Response Team with a WMD delta layered on top of their core responsibilities. While some Teams are certainly more active than others, training, training, and more training cannot take the place of experience. A preferred approach would be to maintain adequate training while displaying a high degree of competency during real world events. This helps eliminate the 'recipe' or 'textbook' approach since hazardous materials rarely go by the book. A team that is well experienced and well trained has the benefit of both worlds. Progressive teams utilize a risk-based approach where their actions are dictated by the risk present and not by some step-by-step process. The FBI Laboratory provides one of the best models of how to respond to WMD threats and events. Their Hazardous Response Unit consists of three distinct groups; FBI Agents, Scientists, and Hazmat Response Specialists. All personnel are cross-trained in hazmat/WMD but each person has an area of specialty that contributes to a well-coordinated and efficient response. The Hazmat Response Specialists are primarily responsible for providing a real-world risk assessment, drawing upon their extensive training and experience very similar to the traditional Hazmat Technician in the civilian sector.

Although our survey revealed several other challenges, we have only listed the top four responses here. As you can see, these challenges are significant and may threaten the very survival of some teams. Without a change in the economic influences, budgets and response agencies will most likely continue to shrink. Doing more with less is the new way of doing business, forcing us to plan better, respond smarter, embrace technology, demand better training, and do whatever we can to retain our valuable personnel. The mission hasn't changed and the threat hasn't gone away, we must have the right response for the right emergency. At some point in the future we will be discussing each of these four topics a little more in depth. Our most sincere thanks go out to those who answered our survey. Your comments, thoughts, and wisdom are well taken and greatly appreciated. **HRW**

Significant Hazmat Events in History

Phoenix/Toluene	Waverly and Kingman/ Liquefied Petroleum Gas
New Orleans / Anhydrous Ammonia	Texas City and Kansas City/ Ammonium nitrate
Bhopal / Methyl Isocyanate	Houston / Anhydrous Ammonia
Henderson / Ammonium perchlorate	Niagara Falls / Love Canal

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