

NEW RULES SPARKED BY FIRES ABOARD AIRCRAFT ARE IMMINENT. IS YOUR COMPANY PREPARED TO AVOID GETTING BURNED?

**Robert A. Richard, PhD
Vice President Regulatory Affairs
Labelmaster Services
Chicago, Illinois 60646**

INTRODUCTION

The U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) in consultation with the Federal Aviation Administration (FAA) issued a Notice of Proposed Rulemaking (NPRM) on January 11th, 2010 proposing to amend the regulations pertaining to the transportation of lithium batteries. PHMSA is the safety agency responsible for protecting the public from the inherent hazards posed by hazardous materials when transported in commerce. FAA shares responsibility with PHMSA and other DOT modal agencies for enforcing the US Hazardous Materials Regulations (HMR). PHMSA and FAA are concerned that the current regulations are not adequate to minimize the risk of fires involving lithium batteries in transport particularly aboard aircraft. Both agencies have been working to address these risks and have held a number of public forums to bring experts together to address the problem.

An estimated 3.3 billion lithium cells and batteries were transported worldwide in 2009 by all modes of transportation, including passenger and cargo aircraft. It is estimated that 20 percent of those batteries are shipped as cargo on aircraft and that proposed requirements and restrictions on the shipments of batteries aboard aircraft could significantly impact commerce. Hundreds of millions of batteries are safely transported aboard passenger and cargo aircraft as cargo and by passengers aboard passenger aircraft in portable electronic equipment and as spares. If the PHMSA rule is adopted as proposed, shippers and carriers (e.g. airlines) could be significantly impacted and in particular those that need to transport their batteries aboard aircraft.

Many affected by the proposed amendments have questioned whether the proposed rules will enhance or compromise safety. Numerous industry associations, foreign governments and individuals have commented on the NPRM. The Whitehouse's Office of Management and Budget (OMB) has responsibility for reviewing and approving the publication of the rule and Has not yet given PHMSA the green light (at least at the time of the submission of this paper) to publish a final rule. This is likely because of the significant opposition from so many parties including small businesses, medical device manufacturers and electronics retailers and questions that have been raised about the effectiveness of the proposed amendments and the accuracy of the cost/benefit analysis. In the meantime, uncertainty about what PHMSA will ultimately adopt is causing companies to hold off on investing in compliance and safety enhancements, developing new businesses and products and hiring employees at a time when the economy is suffering. Those companies using or planning to use lithium batteries for stationary applications should be aware of the pending new rules as they will affect the transport of component cells and batteries and additional restrictions may apply for the transport of equipment containing batteries particularly by aircraft. This paper describes the proposed changes and highlights the concerns raised by the many interest groups and entities that have expressed views in relation to whether PHMSA is on the right track for enhancing safety. The views discussed in this paper are not necessarily those of the author.

BACKGROUND

In general, the risks posed by batteries in transportation are a function of battery size, energy density and chemistry. The high energy density (i.e. high energy to weight ratio) of lithium batteries increases the consequences of a short circuit that can result in generation of heat and fire posing a greater risk in transportation relative to other battery chemistries. Lithium ion and metal batteries are considered hazardous materials for purposes of transportation regulations because they can overheat and ignite in certain conditions and, once ignited, can rapidly propagate and be especially difficult to extinguish. Fire suppression systems aboard aircraft are generally not effective in extinguishing lithium metal battery fires and this increases the risk they pose when transported by aircraft. PHMSA has focused on the safety implications of transporting lithium batteries in commerce for a number of years and has closely monitored incidents involving batteries of all types to better understand the root causes. Incidents are rare and usually the result of non-compliance by shippers that either intentionally choose not to comply with the regulations or are not properly trained and prepared to do so. Nevertheless, these incidents have the potential for resulting in high consequence incidents involving significant loss of life and property damage (e.g. loss of a passenger aircraft loaded with passengers).

As a result of its investigation of a February 7, 2006 incident at the Philadelphia International Airport in which a fire was suspected to have been caused by lithium batteries¹, the National Transportation Safety Board (NTSB) expressed concerns and issued 15 safety recommendations to PHMSA and FAA. The NTSB was critical that the US Hazardous Materials Regulations (HMR) provided regulatory exceptions for certain lithium batteries, such as those used to power laptop computers, cameras, cellular phones, medical devices and personal electronic devices. The NTSB stated that cargo shipments of all sizes of lithium batteries including the smallest button cells should be subject to rigorous packaging and hazard communication requirements and that increased general awareness of the risks of these batteries would result in handlers exercising greater care when loading and unloading packages containing lithium batteries. While NTSB recommended that outfitting cargo aircraft with fire suppression systems would enhance safety, FAA has done little in this regard.

Concerns over the transport of lithium batteries on aircraft were renewed based on suspicions by NTSB, DOT and others that such batteries were involved in the fire on a UPS Boeing 747-400 cargo aircraft that crashed in Dubai, United Arab Emirates (UAE) on Sept. 3, 2010. Investigators from the UAE General Civil Aviation Authority and NTSB have not released a final report on the cause of the crash. According to a recent article in Aviation Week, thick smoke from an on-board fire is known to have filled the cockpit, eventually making it impossible for the pilots to see the flight instruments. In an attempt to return to Dubai, the aircraft overflew the Dubai International Airport before descending and crashing killing both pilots. The concern by some airlines over the dangers of carrying lithium batteries has prompted individual bans of the batteries from the holds of their passenger aircraft. Many cargo operators insist that items containing lithium batteries must be shipped in special packaging to minimize the fire risk.¹

The Dubai investigation is ongoing, but authorities have indicated that the aircraft was carrying a large quantity of consumer electronics coming from China. Many such items, including laptop computers and cell phones, are powered by lithium-ion batteries, which have a known potential to overheat, catch fire and burn intensely if not manufactured properly. Other devices such as electronic cigarettes or “e-cigarettes” that use both lithium metal and lithium ion batteries have been involved in fires aboard cargo aircraft that were investigated by FAA. The e-cigarette batteries that caused a fire aboard a Federal Express MD-11 aircraft at Minneapolis-St Paul on August 14, 2009 were manufactured in China but the manufacturer was not held accountable. Investigators suspected that the batteries were non-compliant and had not been subjected to UN testing. Regulatory oversight of battery manufacturing in China has been criticized as not being sufficient for ensuring that manufacturing controls are adequate and regulators have been criticized that shippers are not held accountable for compliance with applicable international standards and regulations. Domestic regulations in many developing countries are either under development or non-existent.

The FAA has identified 45 air transport related incidents involving lithium batteries and lithium battery powered devices. Overall FAA lists over 113 incidents involving all types of batteries since March 20, 1991 (see http://www.faa.gov/about/office_org/headquarters_offices/ash/ash_programs/hazmat/aircarrier_info/media/Battery_incident_chart.pdf). Two examples include:

¹ 1. It should be noted that the NTSB investigation of this incident did not specifically conclude that lithium batteries caused the fire. The actual cause was not determined.

<p>Date of incident: 6-MAY-2010</p>	<p>Report indicates loose CR123 lithium batteries</p>	<p>Passenger Aircraft</p>	<p>Initial report from Delta Airlines and incident response personnel indicated that while placing a checked bag on a cart at the Seattle-Tacoma International airport, a baggage handler heard a “pop” and saw a flame and then smoke coming from the bag. Airport police and others responded to the incident. The terminal was evacuated. At the conclusion of the response, reports and eyewitness accounts obtained indicated the baggage remnants included the CR 123 lithium batteries.</p>
<p>Date of incident: 9-FEB-2010</p>	<p>Lithium metal battery</p>	<p>Cargo Aircraft</p>	<p>Initial report from United Parcel Service Airline indicated that, subsequent to air transport from Hong Kong, during the local ground portion of the delivery, the truck driver heard a loud pop. First responders were called to the scene. One of the batteries in one of the packages in the shipment ruptured, discharged soot and dislodged other batteries in the package.</p>

The incidents documented by FAA involved fires aboard both passenger and cargo aircraft. There have also been fires involving batteries transported by other modes of transport (e.g. loss of a cargo ship that is alleged to have occurred from a fire that originated in a shipment of nickel metal hydride batteries and loss of more than one UPS vehicle).



Photos taken by PHMSA inspectors as part of their investigation into a reported battery fire in a small parcel air carrier facility.

PHMSA’s latest rulemaking project was sparked by fires that have occurred in transportation involving lithium batteries and energy producing equipment such as those discussed above. The project represents another step in PHMSA’s continuing efforts to ensure the safe transport of lithium batteries and builds on regulations published in 2004, 2007, and 2009. The latest rule is intended to strengthen the current regulatory framework by imposing more effective safeguards, including design testing, packaging, and hazard communication measures for various types and sizes of lithium batteries in specific transportation contexts. A total of 124 persons submitted comments to the January 11, 2010 NPRM. The commenters included battery and electrical device manufacturers, airlines, airline pilots, retailers, battery recyclers, members of the U.S. House of Representatives, the U.S. Small Business Administration, the U.S. Chamber of Commerce and foreign governments.

A final rule was scheduled to be published in January 2011 but the publication date has been delayed several times because of concerns raised by entities affected by the rule changes. At the time of this paper the date of publication is still pending. PHMSA representatives involved in the rulemaking project have been quoted as saying that they may now address the rule changes in two separate published final rules taking more time to address the more controversial proposed changes. At this time it is not clear what the agency will do. This paper focuses on the significant changes adopted in the final rule and provides insight into what the changes mean for the regulated public.

RULEMAKING HISTORY

- **Prohibition on the transport of certain lithium metal batteries on aircraft.** On December 15, 2004, PHMSA published an interim final rule to prohibit the transportation of certain lithium metal batteries (aka primary lithium batteries) as cargo on passenger aircraft. The prohibition resulted from FAA testing that led to their conclusion that current aircraft cargo fire suppression systems are not be capable of suppressing a fire involving primary lithium batteries ignited in flight.
- **Enhanced safety requirements for lithium batteries.** On August 9, 2007, PHMSA adopted a final rule to impose stricter and more effective safeguards applicable to lithium batteries, including design testing, packaging, and hazard communication measures, for certain types and sizes of lithium batteries in certain transportation contexts. In addition, the final rule finalized the prohibition adopted in 2004 on the transportation of certain types of lithium batteries as cargo on passenger aircraft; finally, the final rule imposed limits on the type and size of lithium batteries that may be carried in checked or carry-on baggage on passenger aircraft.
- **Enhanced safety requirements for batteries of all types.** On January 14, 2009, PHMSA published a final rule to clarify and enhance safety requirements for the transportation of all types of batteries. Specifically, the final rule adopted a requirement to report incidents involving batteries and battery-powered devices that result in a fire, violent rupture, explosion, or dangerous evolution of heat and clarified that batteries and battery-powered devices and vehicles must be offered for transportation and transported in a manner that prevents short-circuiting, the potential of a dangerous evolution of heat, damage to terminals, and, in the case of transportation by aircraft, unintentional activation.

CURRENT REGULATORY REQUIREMENTS

Lithium batteries are fully regulated hazardous materials but there are regulatory exceptions for small batteries and cells. Small batteries are those lithium metal batteries with not more than 2 grams aggregate lithium content and lithium ion batteries with an aggregate equivalent lithium content (ELC) of not more than 8 grams. Packaging and design type testing requirements for lithium batteries are found in the US HMR and the applicable international regulations but the HMR does not address the most recent internationally recognized safety amendments. For transportation by all modes, lithium batteries of all types and sizes must pass the applicable tests in the United Nations Manual of Tests and Criteria. These tests are designed to ensure that the battery can withstand conditions normally encountered in transportation. In addition, batteries must be designed in a manner that precludes a violent rupture and must be equipped with effective means of preventing external short circuits and a means to prevent reverse current flow if cells are connected in parallel. Unfortunately, the current US regulations are not aligned with international regulations that were updated based on international discussions and consensus. Aligning the US HMR with these international regulations would go a long way to enhancing safety without imposing unreasonable burdens on commerce. PHMSA and FAA's intent on adopting additional measures have stalled the adoption of the critical international safety requirements putting US citizens at risk while establishing an environment of uncertainty amongst those subject to the HMR.

Lithium batteries must be packaged in accordance with PHMSA regulations and must be packaged so as to prevent short circuits, including movement that could lead to short circuits. A package containing lithium batteries must have a Class 9 hazard label and must be accompanied by a shipping paper that describes the lithium batteries being transported and emergency response information. Lithium batteries that exceed 12 kg gross weight are not permitted on passenger aircraft and may only be transported on cargo aircraft if approved in writing by PHMSA. Generally, shipments of small lithium batteries are excepted from certain packaging and hazard communication requirements; however, PHMSA is proposing to eliminate these exceptions and has proposed much more stringent requirements for all lithium batteries. If adopted as proposed, all lithium batteries would have to be packed in UN specification packaging and conform to more stringent hazard communication requirements including shipping papers, markings, labels and emergency response information. In addition, eliminating the exceptions would provide notification to the pilot in command of the presence of lithium batteries, the number of packages, and their stowage location. PHMSA also proposed to require manufacturers to provide results of satisfactory completion of UN design type tests for each lithium battery and cell type and for the batteries to have a mark indicating that they have passed the applicable tests. The intended effect is to promote knowledge of the UN Tests throughout the world and enhance compliance. These changes do not on the surface to be unreasonable but those impacted have vigorously opposed the requirements for a myriad of reasons. They have criticized the agency for taking an approach that they say will pose unnecessary burdens on an industry that has an excellent safety record and for proposing rules which may in fact compromise overall safety placing the flying public at risk.

WHAT IS PHMSA CONSIDERING IN THEIR RULEMAKING PROJECT?

1. For air transportation, regulating all lithium cells and batteries as Class 9 material. They are considering some exceptions for cells and batteries that are shipped in very limited quantities such as button cells and other small batteries that are placed in equipment and those that may be acceptable to FAA (It is not clear what this means) for use in equipment aboard aircraft.
2. Requiring manufacturers to provide results of satisfactory completion of UN design type tests for each lithium battery and cell type and for cells and batteries to be marked with the letters “un” (similar to the UL mark which is frequently applied fraudulently on counterfeit batteries) to indicate they passed the applicable tests.
3. Revising current shipping descriptions for lithium batteries (UN3090), lithium batteries packed with equipment (UN3091) and lithium batteries contained in equipment (UN3091) to specify lithium metal batteries including lithium alloy batteries as appropriate. Adopt shipping descriptions for lithium ion batteries including lithium ion polymer batteries (UN3480), lithium ion batteries packed with equipment including lithium ion polymer batteries (UN3481), lithium ion batteries contained in equipment (UN3481) including lithium ion polymer batteries. This is actually a welcomed change by most since it aligns with international regulations.

Currently, under the HMR, primary (non rechargeable) lithium batteries and secondary (rechargeable) lithium batteries share the same UN number. However, differences in chemistry, functionality and behavior when exposed to a fire are well documented. Based in part on the previously mentioned FAA fire tests PHMSA imposed additional requirements on primary lithium batteries including prohibiting them from transportation aboard passenger aircraft, unless packed with or contained in equipment. The fact both primary and secondary lithium batteries share the same UN number, yet are regulated differently has the potential to cause significant problems in acceptance procedures for carriers and may unnecessarily hinder or delay the transportation of these products.

4. Adopting watt-hours in place of equivalent lithium content to measure the hazard associated with lithium ion batteries.

When requirements for lithium ion batteries were first adopted into the HMR it was necessary to provide an indication of lithium cell and battery content. Since lithium ion batteries do not contain metallic lithium, an expression of lithium content analogous to lithium metal batteries was devised. This term became known as equivalent lithium content or (ELC) also known as lithium equivalent content. The term equivalent lithium content is not widely used or understood and can lead to confusion when calculating the ELC of a battery. PHMSA proposed to adopt a term called watt-hour. The term watt-hour, expressed as (Wh) is commonly used in electrical applications. The watt-hour value of a lithium ion cell or battery is determined by multiplying a cell or battery’s rated capacity in ampere-hours, by its nominal voltage. Therefore, watt-hour (Wh) = ampere-hour (Ah) x Volts (V).

5. Establishing limits on the number of lithium cells and batteries that may be contained in a single packaging and limits on the number of packages containing cells and batteries that may be transported in a unit load device (ULD), pallet or container; and, for transportation on board aircraft, consider additional limiting requirements for lithium cells and batteries unless transported in a “fire resistant container”. Unfortunately neither PHMSA or FAA have defined any specifications applicable to a “fire resistant container”.

While the HMR impose weight limits on a single package, the HMR do not limit the number of packages that may be placed on a pallet, a ULD or similar overpack. FAA testing has shown the number of batteries involved in a fire directly effects the duration of a fire. Limiting the number of packages that may be placed on a pallet or in a freight container may limit the duration of a fire involving lithium batteries.

6. For all transport modes, requiring lithium cells and batteries to be packed in a manner that protects the cell or battery from short circuits (e.g. placing them in individual inner packagings).

Currently, the HMR state that “each lithium battery or cell must be packed in inner packagings in such a manner as to prevent short circuits, including movement which could lead to short circuits.” This proposal would specify effective methods to achieve this objective including individually packaging each cell or battery.

7. Providing provisions for the transport of lithium cells and batteries of all types for recycling or disposal and prohibiting or applying appropriate safety measures for the transport of these items in the aviation mode.

8. Consolidating and simplifying lithium battery requirements in one section of the HMR.

Currently in the HMR, regulations pertaining to the transport of lithium batteries are scattered throughout the HMR (e.g. requirements and exceptions are provided in special provisions such as 29, 188 and 189) which is confusing. This results in inconsistent understanding and implementation of the regulations, potentially undeclared and frustrated shipments. In the NPRM, PHMSA proposed to consolidate the regulations pertaining to the packaging of lithium batteries to § 173.185 and regulate the transportation of lithium batteries in a manner similar to other hazardous materials.

9. Unless transported in a fire resistant container on board aircraft, PHMSA proposed to limit stowage of lithium cells and batteries of all types to crew accessible cargo locations on aircraft.

Currently, the HMR do not impose quantity limitations or restrict the stowage location. In the NPRM, PHMSA proposed to restrict stowage of lithium batteries to those locations accessible to crew members to permit immediate investigation and response to indication of smoke or fire from lithium batteries. Some have questioned whether this will increase the probability that lithium batteries which present a potential source of ignition will be stowed in close proximity with other hazardous materials such as explosives, flammable liquids and gases.

10. Applying appropriate safety measures for the air transport of lithium cells or batteries identified by the manufacturer, the Consumer Product Safety Commission, or the Department of Transportation as being defective for safety reasons, or for those that have been damaged and prohibiting the improper transportation of these items in the aviation mode.

The HMR do not currently address the transport of damaged, defective or recalled batteries. PHMSA and FAA previously advised the public to restrict batteries subject to a recall to ground only transportation but this remains informal guidance. In certain circumstances a battery may fail during product testing or under certain unusual circumstances and require expedient transportation back to the manufacturer. PHMSA stated that defective or failed batteries may be safely transported by all modes provided the battery is individually packed and is accompanied by appropriate hazard communication. The NPRM proposes requirements to transport such batteries.

IS PHMSA ON THE RIGHT TRACK FOR IMPROVING SAFETY?

Many industry representatives have been extremely vocal concerning the approach that PHMSA has taken in response to the small but serious number of incidents and have questioned whether the agency's actions will be effective in reducing incidents. Many argue that the complexity of the regulations and the lack of harmonization with international regulations directly contribute to lax compliance and in some cases provide incentives for unscrupulous shippers to offer batteries as "undeclared shipments" which pose significant risks to safety and cast a negative image for the industry as a whole. The majority of incidents noted on FAA's Lithium Battery Incident Summary primarily involved batteries that were not in compliance with the existing regulations. Critics claim that many of these incidents were not properly investigated to determine the root cause and the responsible parties were not appropriately held accountable. New regulations may not have any effect on the actions of individuals who unknowingly, intentionally or otherwise fail to comply with the HMR from committing similar acts in the future. The proposed differences from international regulations will undoubtedly result in significant confusion particularly for those in the countries that have the least safety oversight resulting in increased frequency of undeclared shipments. Many believe the proposed rules will create an environment where more shipments are offered intentionally or unintentionally, out of compliance with U.S. regulatory requirements which could result in an increase in the number of incidents. Opponents of the agency's approach have indicated publically that PHMSA and FAA would be more effective if they were to devote their resources to cracking down on the irresponsible companies and individuals who are failing to comply with the current rules. It has been suggested that PHMSA work through the international regulatory community to raise awareness and promote outreach that results in enhanced compliance with current requirements. For example, PHMSA could do more to address the compliance vendors of lithium batteries that are frequently sold via online auction sites and subsequently transported in commerce including via the US Postal Service.

It is fair to say that some in the international dangerous goods regulatory community are generally outraged at PHMSA's unilateral approach to addressing the problem. PHMSA appears to be taking an approach that is inconsistent with every government agency outside the US and the leading international safety organizations. One of the most critical factors for battery safety is ensuring that they are properly designed and manufactured with appropriate safety features. The vast majority of batteries that have failed and resulted in fires during transportation have been those that are not properly designed, tested or manufactured. This is particularly prevalent for counterfeit batteries. Getting the word out to manufacturers worldwide that lithium cells and batteries must be tested has been a challenge. Additional outreach and education would go a long way to reducing incidents and enhancing compliance. Another challenge is making shippers aware of the necessity to properly package batteries for transportation and holding them accountable.

PHMSA is basically telling the rest of the world that PHMSA knows better. This has resulted in a number of letters and visits by foreign government officials to OMB. It also serves to compromise PHMSA's relationships with international safety partners that took years to establish. Even though PHMSA and FAA participated in discussions during international regulatory development forums such as the International Civil Aviation Organization's Dangerous Goods Panel (ICAO DGP) they are now taking an approach contrary to the agreements reached in these international forums. The ICAO Technical Instructions on the Safe Transport of Dangerous Goods by Air (ICAO TI) is the international regulation that applies to the transportation of hazardous materials aboard aircraft. The ICAO TI has gone through significant revisions during the last four years with regards to lithium battery transport. Additional marking and documentation requirements have been adopted and packaging standards have been improved. Packaging instructions have been modified to be more clear and user-friendly. These efforts have raised awareness of the importance of lithium battery safety and improved understanding worldwide. Elimination of exceptions for small batteries in the U.S. will counter the gains made by ICAO and will introduce significant confusion. The results will be shipments of batteries and equipment that will say "forbidden for transport by aircraft" for road movement but are perfectly acceptable for an air shipment from Canada for instance. One can only imagine how confusing the eventual US variations will be to shippers and carriers who already struggle with understanding why one simply can't follow the ICAO TI for international air transport.

SUMMARY

PHMSA estimated the costs of the proposed new rules not exceed \$9 million; however industry has estimated the costs to be over \$1.2 billion. One has to wonder whether the cost analysis was conducted objectively or under duress from particular legislative staff. At a recent PHMSA public meeting a number of industry representatives made strong statements in opposition of PHMSA's initiatives including:

"In a nutshell, this proposal, if adopted as a final rule, will have a tremendous negative impact not only on the battery manufacturers and distributors but on virtually every facet of commerce within industries that employ portable energy sources as components, including aircraft manufacturers of present and future."

"It's extremely important to recognize that the PHMSA proposals, if implemented, will impact the entire U.S. economy. International competitiveness will be compromised, and U.S. jobs will be put in jeopardy. From an air carrier perspective, U.S. carriers will be placed at competitive disadvantages with respect to foreign carriers that are not subject to the same rules, and the proposed new restrictions may drive businesses out of the United States as shippers turn to alternative carriers and transportation modes."

A representative from a medical equipment supply company stated "We think that the new rules will cause severe disruptions and bottlenecks to the current shipping practices of implantable medical devices which will inevitably threaten patient access to these lifesaving and life-enhancing medical devices."

A representative from a lithium battery trade association stated "Unfortunately, this PHMSA rule on lithium batteries ignores repeated calls for improved compliance, increased enforcement, and PHMSA adoption of stricter international transportation regulations. Together, these measures would resolve the very safety issues that the PHMSA seeks to address in their rulemaking. This rulemaking will disrupt the most efficient business models in the world. It will unnecessarily limit consumer choices and increase consumer prices. It should be set aside and replaced with a rule that belatedly adopts the international lithium battery transportation regulations that have been in effect over the rest of the world."

Don't be caught off guard! It is critical to monitor PHMSA's continued efforts to implement additional regulations that could impact your ability to ship your products. This presentation addresses the main points in the proposed rules; however they are complex and each affected party should study them carefully. Failure to comply could result in significant fines and threaten your company's ability to transport your products. Feel free to contact the author to discuss how your company can become compliant and simplify your compliance efforts.

REFERENCES

1. Richard Burchell, *Lithium Battery Fire Risk Probed In Dubai Crash*. Aviation Week, Sep 21, 2010.
The opinions highlighted in this paper are not necessarily those of the author.