

## THE CASE OF THE BURNING LAPTOPS

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*This case was prepared by the author ( Christman)and is intended to be used as a basis for class discussion. The views represented here are those of the case author and do not necessarily reflect the views of the Society for Case Research. The views are based on professional judgment.*

### Introduction

In May of 2006, Jane Smith approached her son Tommy's bedroom to put away his laundry and gasped in horror at what she saw. A cloud of smoke was creeping out from under the closed door. She rushed to the bedroom, threw open the door and saw the unlikely source of the smoke: Tommy's laptop computer, which was crackling and popping as it filled the room with the acrid smell of burning plastic. Calling for Tommy and her husband, Mrs. Smith snatched up the laptop and dashed to the yard where she dropped it a safe distance from the house. At this point, flames erupted from the lower right hand corner of the laptop. After extinguishing the flames, the puzzled family inspected the blackened device. Flipping over the charred laptop, Mr. Smith noticed that the area where the laptop's battery once rested was now a glob of melted plastic and twisted metal. This discovery led him to suspect that the laptop's battery pack was the source of the flames. The Smiths were not aware that a laptop battery could self-combust, but the blackened computer suggested otherwise. The Smiths speechlessly stared at the scorched shell that had once been Tommy's favorite possession and pondered the question "could a laptop battery really spontaneously burst into flames?" If so, was this an isolated occurrence and, if not, why hadn't they heard about the problem before? What and who was responsible for the fire that could have cost them their home?

As it was, the fire in the Smith's laptop was not an isolated incident. Between 2001 and the time of the Smith's fire, the Consumer Product Safety Commission (CPSC) had received reports of 47 incidents involving smoke or fire from laptop batteries (Hesseldahl, 2006). CPSC had also recorded 339 incidents of overheating of lithium ion batteries in laptop computers, cell phones, digital cameras and other portable devices since 2003 (Hughlett, 2006). During the same time frame, there had been at least 13 lithium-ion battery recalls and the Federal Aviation Administration recorded five fires on planes involving lithium-ion batteries (Hayes, 2006). Other specific incidents that had occurred prior to the Smith's laptop fire that were attributed to laptop batteries were: a fire that burned a two-story apartment complex, a fire in a kindergarten classroom, a fire in a dorm room that severely burned the user, a hotel bed igniting and causing the room to catch fire, and a fire in a laboratory which burned the desk on which the laptop sat (Schechter, 2006). The aforementioned reports of fires and overheating were believed to be just the tip of the iceberg for battery failures as batteries that failed without physical manifestations were simply replaced and not reported.

Even as the safety of lithium-ion batteries came into question due to the fires and recalls, consumers had an insatiable appetite for portable electronic devices that were small and lightweight, yet were powerful and had a long runtime. No other alternatives to lithium-ion

batteries had been developed to power those devices. Numerous advantages were provided by Lithium ion batteries over all other battery technologies. Lithium ion batteries weighed much less than other types of rechargeable batteries. By reducing the weight of the battery in a device, the overall weight of the portable device could be reduced. They also held their charge longer than other types of rechargeable batteries. This translated to fewer battery purchases over the lifetime of an electronic device. An important advantage is that they did not need to be completely discharged before recharging them. Users of portable electronic devices found this extremely convenient since it allowed them to charge all their devices overnight rather than having to wait until they completely discharged, which usually occurred at an inconvenient time. Finally, lithium ion batteries withstood hundreds of charge/discharge cycles (Brian, n.d.). Again this provided a convenience for users who tended to charge their devices every day. It was estimated that the global demand for lithium-based secondary batteries would reach \$12.95 billion in 2010, up from \$6.67 billion in 2005. US demand would also grow from \$800 million to \$1.48 billion in the same time period (Carbone, 2007).

### **Operation of Lithium Ion Batteries**

In order to understand why lithium-ion batteries were spontaneously combusting, it was necessary to understand their structure and operation. Within a lithium-ion battery there was a negatively charged cathode, made from carbon, and a positively charged anode made from lithium cobalt oxide. Each electrode was contained in a thin sheet and the two sheets were separated by a third thin sheet called a separator. The separator, a very thin sheet of micro-perforated plastic, was designed to create a barrier that prevented the anode and cathode from making contact, while allowing ions to pass through it. The three sheets were spiraled to fit within the familiar cylindrical metal case. Surrounding the spiral of sheets was an electrolyte, a flammable liquid solvent that provided free electrons (negatively charged particles). When the battery was charged, the free electrons moved through the electrolyte and collected on the carbon of the negatively charged cathode. Once the battery was attached to a circuit, the negatively charged electrons, attracted to the positive charge of the anode, moved through the circuit from the cathode to anode. This movement of free electrons through the circuit provided the electrical conductivity of the battery. As the supply of free electrons moved through the circuit to which the battery was attached, the charge of the battery decreased. The voltage produced by each lithium ion battery was 3.7 volts, more than double the amount produced by a normal alkaline AA battery (Brian, n.d.).

### **What Caused Lithium Ion Batteries to Catch Fire?**

In batteries, short circuits have occurred if at any time the cathode and anode came in direct contact with each other. Short circuits have always been extremely dangerous because electrons travelled at a rapid rate from cathode to anode with no circuit to add resistance and slow them down, thus heat was rapidly generated. As described previously, a separator was used within a lithium-ion battery to ensure that the anode and cathode would not come in contact with each other. However, during the manufacturing of the batteries, tiny pieces of metal called dendrites were created which remained floating in the liquid solvent of the battery. These tiny pieces of metal started to move around in the solvent if there was sufficient heat generated in the battery during charging or use or even if the battery was left in a hot environment (Wilson, n.d.).

In some cases, the action of the metal pieces was enough to puncture the separator thus providing a conduit through which the anode and cathode came into direct contact and caused a short circuit.

There were numerous ways in which the batteries failed once a short circuit occurred. In most cases, the battery pack simply powered off. A user, not knowing that the short circuit occurred, most likely assumed that the battery pack was bad and replaced it. When a spark was created from the short circuit, the flammable liquid within the battery ignited and spread quickly through the entire battery pack (Wilson, n.d.). Even in situations where a spark was not created, the intense rise in temperature caused by the short circuit caused the flammable liquid inside the battery to ignite. Computer models have estimated that the temperature inside of the battery reached 200° C within one second (Jacoby, 2007).

In some cases, the rapid rise in temperature increased the pressure within the cylindrical metal case to the point at which it exploded. While the result was not as catastrophic as a fire, the entire battery was rendered useless.

### **Laptop Battery Timeline**

Sony Corporation was the first company to successfully commercialize the lithium-ion battery in 1990, and by 2006 it was the second largest manufacturer in the world of lithium ion batteries for use in personal notebook computers. Sony took great pride in the lithium-ion battery as its engineers had worked arduously in its development (EDITORIAL: Rough patch for Sony, 2006). In 2006, Sony held approximately 30 percent of the global market share of laptop batteries (Takahashi, 2006) and its batteries were used by every major laptop computer maker, including Apple, Dell, Lenovo, Fujitsu, Toshiba and Sony itself. An estimated 20 million laptop batteries were produced by Sony each year.

While Sony had seen great success and market share with its lithium ion batteries from 1991 to 2006, it had experienced some hurdles along the way. In 2000 a Sony battery pack in a Compaq computer overheated and started emitting smoke. This single incident prompted a recall of 55,000 Sony batteries used in Compaq laptops (Nakamoto, 2006). Other computer manufacturers, including Hewlett Packard, Apple and Dell, also issued recalls of laptop batteries for similar reasons. During the same month as the Compaq recall, October of 2000, 27,000 batteries from Dell were recalled (“CPSC, Dell Announce Recall”, 2000). In both cases, the reason given was the possibility of short circuiting and overheating, yet there were no injuries reported in either case. The possibility of short circuiting was also the reason for Apple’s 28,000 unit recall of rechargeable batteries in August of 2004 (“CPSC, Apple Announce Recall”, 2004). Almost a year later, Apple recalled another 128,000 rechargeable batteries due to possibility of overheating (“CPSC, Apple Announce Recall”, 2005). Experiencing the same problems with its notebook computer batteries, Hewlett Packard issued a voluntary recall of 135,000 battery packs worldwide in October of 2005 (“CPSC, Hewlett-Packard Company Announce Recall”, 2005). In December of the same year, Dell announced its second recall in 5 years, this time involving 22,000 battery packs (“CPSC, Dell Announce Recall”, 2005). The batteries involved in these recalls were not only manufactured by Sony, but also by Sanyo and LG Chemical Ltd. ([www.CPSC.gov](http://www.CPSC.gov)). Because there were a variety of manufacturers and the recall numbers represented only a small fraction of their total production, the recalls went relatively unnoticed.

While the battery recalls that occurred from 2000 to 2005 did not receive much media attention, the highly publicized incidents of laptop battery fires that took place during 2006 put the reputation of Sony, along with those of its supply chain partners, to the test.

Between December of 2005 and August of 2006 there were six fires in Dell laptop computers, including one that burst into flames at a conference in Osaka (Takahara, 2006). The self-combusting Dell computer was caught on tape and the video footage was viewed worldwide on the internet. Concerned about customer safety, Dell recalled 4.2 million laptop batteries on August 14, 2006 (Dell Vice Pres. Denies PC Design Flaw in Battery Recall, 2006). All of the batteries in this recall were manufactured by Sony. Dell's decision to initiate a recall was based on six incidents, none of which resulted in injury, from among 20 million batteries in the marketplace (Anonymous, Case Study: Dell Learns That Core Central Messages & Customer Safety Bode Well In A Crisis, 2007). Responding to the recall, Sony indicated that it believed the problems were not with the batteries themselves, but with the way the computers were designed. Defending its product, Dell refuted the claim that the failures were due in part to a PC design problem (Dell Vice Pres. Denies PC Design Flaw in Battery Recall, 2006). While maintaining their innocence, Sony did contribute towards the costs of the recall. Believing that the safety problem that sparked Dell's recall only existed in Dell computers, Sony would not release the names of other companies to whom it had sold the same batteries (Turner & Waters, 2006).

After nine reports of batteries overheating including two incidents of minor burns, Apple recalled 1.8 million batteries on August 24, 2006. This recall affected 1.1 million batteries in the United States and 700,000 more globally. What they all held in common is that they, like the recalled Dell batteries, were all manufactured by Sony. At this point Sony admitted that the overheating problem could be due to metal particles in the batteries but insisted that the method in which Apple installed the batteries was the root cause of the fires (Smith, 2006). Sony assisted Apple in covering the costs of the battery recall, but continued to insist that the fault did not lie with its batteries (Sony to Initiate Global Replacement Program for Notebook Computer Battery Packs, 2006). Standing firm in this belief, Sony announced that there would not be any other recalls necessary other than the ones for Dell and Apple laptops (Darlin, 2006).

Although Toshiba had not received any reports of its battery packs overheating, on September 9, 2006 it issued a recall of 340,000 laptop batteries to ease customer concerns (Hesseldahl, 2006). On September 29, 2006, it increased the number of batteries it was recalling to 830,000, all of them manufactured by Sony (Morse, 2006).

Lenovo, the company that took over IBM's laptop manufacturing division, initially believed that its batteries were not prone to the same problems that Dell and Apple saw. Although it used Sony batteries, it designed its own battery packs which failed safely by shutting down before overheating. Its battery packs also included extra ventilation for heat to escape (Krishnan, 2006). Those safety mechanisms themselves failed on September 19<sup>th</sup> when the laptop of a passenger at the Los Angeles airport started emitting smoke and flames as he was boarding the plane. Thanks to the speedy actions of an alert flight attendant, the computer was doused with a fire extinguisher and catastrophe was avoided. The highly publicized battery fire at the Los Angeles airport prompted the company to recall 526,000 batteries on September 28, 2006 (Takahara, 2006). Even though Lenovo battery packs were designed with measures in place to avoid

overheating, Sony remained strong in its stance that the fires were not caused by the batteries, but by the way the manufacturers installed them.

Between September 29 and October 13, 2006, Fujitsu Ltd. initiated a voluntary replacement program for Sony-made battery packs (Morse, 2006). Up until that point Fujitsu had not had any reported incidents of fires in its PCs, but it did use the same battery packs that had been used by Dell and Apple. However, on October 27, one of its notebook personal computers emitted sparks and caught fire while it was recharging, resulting in light burns to the user. Although Fujitsu reported that the fire was caused by a defective Sony-made battery pack, Sony responded that it could have just as easily been a defect in the PC (Fujitsu Notebook PC Catches Fire, Burns Japanese User, 2006).

### **Corporate Actions**

The laptop battery fires of 2006 were another, in an ever-expanding list of a product harm crises. Defined as “discrete, well publicized occurrences wherein products were found to be defective or dangerous” (Dawar & Pillutla, 2000), product harm crises have been shown to negatively affect a company’s market share as well as its reputation. Research has indicated, however, that damage could be minimized by what consumers viewed as a company’s appropriate response to a product harm crisis. By understanding how consumers were likely to perceive the crisis and the response, research has provided managers with recommendations for response strategies to lessen the damage (Coombs & Holladay, 2002). Siomkos and Kurzbard (1994) proposed the company response continuum, which included four strategies for dealing with product harm crises. The four strategies that have been traditionally employed in product harm research are denial, forced or involuntary compliance, voluntary compliance, and super efforts. In denial, the company claimed that it was not responsible for the defective product or that there was no threat from its product. When a company acted with forced compliance, it only recalled the product or participated in other remediation efforts after being forced to do so by a government agency such as the Consumer Product Safety Commission. When a company recalled a product or took remediation efforts on their own accord prior to governmental intervention they employed the voluntary compliance strategy. Super effort went above and beyond voluntary compliance by offering recalls, compensation and honest and extensive communications related to the crisis. Companies that utilized super effort not only showed concern for consumer welfare, they also exhibited corporate social responsibility.

Dell’s 2006 recall of 4.2 million laptop batteries was, at the time, the largest recall in the history of consumer electronics. As such, Dell was in the position to set the standard for how to handle a recall of such magnitude. In order to inform and educate consumers of the battery defect and recall, an extensive campaign was launched. Communication to customers included key media sources such as *The New York Times*, *CNBC* and executive interviews with the *Today Show* and *Bloomberg TV*. Cognizant of the growing trend of consumers to stay abreast of recent events over the internet, Dell expanded its blog site as well as maintained a comprehensive recall website. Expanding well beyond just keeping their customers informed, an extensive campaign was launched that included educating employees about Dell’s support for customers along with delivering of updates to top investors and financial analysts. (Anonymous, Case Study: Dell Learns That Core Central Messages & Customer Safety Bode Well In A Crisis, 2007).

Although Apple's recall came 10 days after Dell's, it also went to great lengths to make sure that the public knew of the recall and was aware of the process to replace a defective battery. Apple launched a web-based media campaign as well as sending emails to all registered owners of affected laptops (Smith, 2006). Like Dell, Apple took financial responsibility for the battery replacement program even though Sony continued to blame the computer manufacturers and was only willing to partially pay the replacement costs.

Even though Toshiba, Fujitsu and Lenovo each issued recalls on a much smaller scale than those of Dell and Apple, each followed suit with press releases and internet web sites to keep customers informed of their replacement programs (Hesseldahl, 2006; Morse, 2006). Due to the media attention that had been garnered by the first two recalls, there already existed a heightened public awareness of the problem. All five manufacturers worried first about providing consumers with safe batteries through the replacement program and secondly about seeking financial reimbursements from Sony.

### **Sony's Response**

During August and September of 2006, while Dell, Apple, Lenovo, Fujitsu, and Toshiba were all issuing recalls of their laptop batteries, Sony continued to make known that it was only a supplier of the batteries and the problem should be dealt with by the computer manufacturers. Even after it acquiesced and took some responsibility for the failures, Sony still only released information over the internet. No apology or explanation of the problem was offered to the public (Sony Finds Reputation in Danger, 2006). Much was at stake for Sony in its handling of the battery fires. It faced accusations of social irresponsibility, legal actions, replacement costs and possibly a ruined reputation. All of these were issues that other companies had previously grappled with in a product harm crises (Siomkos G. J., 1999). Failure of other firms to respond appropriately to the crises resulted in repercussions that extended well beyond an impact in sales of the defective product. Product harm crises have been shown to negatively affect market shares, sales of the recalled product, stock prices and sales of other company products (Pruitt & Peterson, 1986; Siomkos & Kurzbard, 1994).

At long last, on October 24, 2006, a full 8 weeks after the Dell recall, Sony recalled 250,000 batteries for its own Vaio notebook computers around the world. Still not willing to take full responsibility for previous battery failures, Sony stated that the recall of Vaio computers was voluntary and only to give consumers peace of mind (Sony to recall 250,000 notebook batteries, 2006).

On the same day that Sony announced its battery recall, Sony's Executive Vice President, Yutaka Nakagawa, apologized for the first time. His statement was, "We would like to apologize for the worry that we have caused. I take the matter seriously and I want to complete the battery-replacement program as quickly as possible to wipe away concerns." While apologizing for the battery problem Nakagawa emphasized that it was an isolated incident and was not an indication of a decrease in the quality of Sony's manufacturing. He pledged to regain public trust through efforts for quality improvements. Nakagawa also maintained that the

batteries only overheated and caught fire in rare instances that depended on how other companies (the computer manufacturers) configured the batteries for recharging (Kane, 2006).

The sincerity of Sony's apology came under scrutiny as Nakagawa did not bow deeply while giving it. His gesture, along with the announcement that no executive would resign over the recall and a lack of explanation as to why Sony was the only lithium ion battery manufacturer with this problem left most people questioning whether Sony was genuinely sorry for the problem or if it was simply trying to repair the negative image it had gained in the public eye (No longer the hardest word, for Sony, 2006).

Ryoji Chubachi , the president of Sony's electronics division, did not speak out about the problem until December 1, 2006. At that time Chubachi attributed the problem to the company's lack of technological risk management. He indicated that while working to improve technology productivity, "management did not anticipate risks enough." He admitted that Sony was slow in responding to the problem with the batteries overheating and that caused the public to believe they were concealing the problem (Sony chief traces battery overheating to lack of crisis management, 2006).

### **Summary**

By the end of 2006, 9.6 million lithium ion battery packs made by Sony for laptop computers were recalled worldwide, making it the largest product recall in the history of mankind. Fires caused by lithium ion batteries resulted in property damage and minor injuries while the total cost of the recall to Sony was reported to be 51.2 billion Yen (\$436.7M) (Sony chief traces battery overheating to lack of crisis management, 2006). Along with Sony, almost every laptop computer manufacturer that used its batteries was affected by the recalls. Each of the six companies involved faced difficult decisions on how to react to the battery failures. Profit margins and reputations were both at risk as the companies had to opt to recall or not. Which choice was the right one for each company? What was the right thing to do for its consumers? When a component of a product failed, who ultimately should have taken responsibility for the failure, the product manufacturer or the component manufacturer?

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