 

## THE BURGOYNE MEMORIAL LECTURE

# CONTINUING OUR JOURNEY IN SAFETY—IMPROVING THE WAY WE LEARN FROM LESSONS IN SAFETY

Aidan Hayes[1] and Frederic Gil[2]
[1]BP Group Safety Director
[2]BP Group HSSE Knowledge Management Advisor

> 'Companies are composed of human beings and that means we will make mistakes. Things will go wrong. The challenge is not to deny that reality but to learn from every mistake and to do everything in our power to ensure that mistakes are never repeated' – *Lord John Browne of Madingley — CEO, BP Plc*

## INTRODUCTION — OUR JOURNEY IN SAFETY

For the last fifteen years, BP has been successful in continuously improving the safety of the workforce. It is a simple fact that our performance in safety, as measured by the reduction in serious injury frequency, has improved by a factor of 10 over 10 years. This continuous improvement has been successfully delivered despite the multiple mergers and acquisitions which have more than tripled the size of the Company over the past 6 years and had increased our employees and core contractor workforce to well over 250,000 people. As well as delivering an overall improvement in our accident frequency rate the number of fatalities involving our workforce has also decreased significantly over the past 10 years.

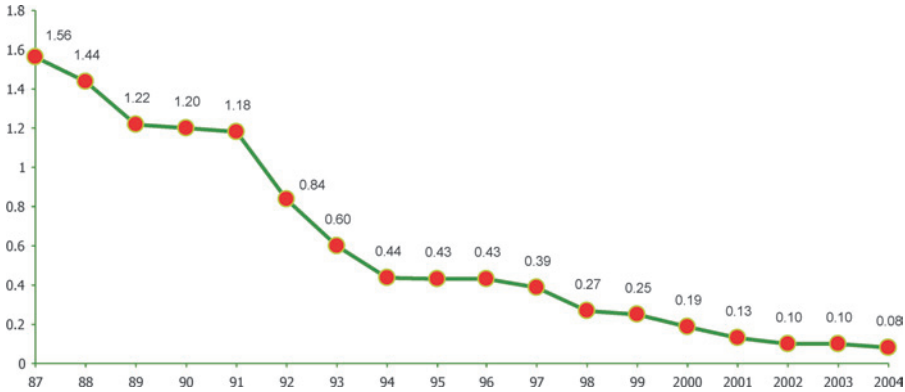


**Figure 1.** BP Safety DAFWCf Performance 1987 – year to date 2004

The safety performance graph shown in Figure 1 above illustrates the continuous reduction in injury frequency since 1987.

Apart from the compelling moral and human obligation to continuously improve the safety of our workforce, incident prevention also contributes to operations excellence and prevents business loss as the following BP statistics will attest:

- The average cost of a serious incident in a BP process plant (chemicals, refinery, platform . . .) varies from $2m to $10m. In 2001 BP had 3 incidents above $50M and one close to $300m. The average cost of a refinery outage is $2.334m
- The cost of a LTI case in BP is estimated to be on average $150k *(based on a study of 97 BP workforce lost time injury cases from 2003 which include medical costs, cost of replacement resource, loss of production and investigation, costs of corrective actions etc.)*
- The cost of a non fatal single serious Heavy Goods Vehicle accident is estimated between $500k to $1.5m.

## THE INGREDIENTS OF SUCCESS

It is enlightening to look back over the past 15 years to identify the incidents, interventions and individual acts of leadership that occurred to create the regular step changes in BP's safety performance. Although BP has been operating successfully for 100 years and for the most part has been successful in managing safety, the year 1987 was chosen the start and a significant milestone in our official safety journey. It was in 1987 when 3 significant fire and explosion incidents occurred at our Grangemouth petrochemical plant in Scotland resulting in the death of 3 of our contractor employees. These separate incidents were fully investigated by the Health and Safety Executive and as a result of their findings BP was prosecuted and found guilty of not providing safe systems of work to ensure a safe workplace. As a result of the HSE prosecutions BP was fined a total of £750,000, a record fine for a British company at the time. These incidents not only resulted in the tragic death of three of our valued workforce, resulted in significant losses in production and damage to plant but also badly effected our corporate reputation and shattered our complacency.

Due to the human and financial consequences of these three incidents BP senior management moved into immediate action and by making expectations clear on how safety across BP should be managed in the future and the accountability of management to ensure the safety of our people, BP employees or contractors. Since then we have set strategic direction for safety at corporate level, carefully tracked our performance in safety across our global operations and have been committed to continuous improvement in our safety performance year on year.

From 1987 onwards there was a progressive shift of the accountability for safety from the safety professionals and advisors to the operational line management and over the ensuing 3 years the required competencies in managing safety were identified and developed. Over the period 1987–1990 all managers and supervisors were trained in the International Safety Rating System (ISRS) to ensure that management at all levels

were trained in the ISRS safety management system and made aware of their accountabilities for the safety of their people.

In 1990 the formal recognition of line accountability for safety was introduced in management performance contracts by the MD for HSE, Russell Seal who in 1990 delivered a clear message to BP management by his memorable statement of expectations 'If you can't manage safety, you cannot manage' making safety an essential competency for BP managers. Since 1990 safety, owned by the line and fully accountable for performance has been the primary force that created the environment to deliver the remarkable performance improvement illustrated by the graph shown in Figure 1.

This continuous improvement in our safety performance since the early nineties has been achieved by not only being clear about line accountability for safety but also by getting the basics right such as making our safety expectations clear to our entire workforce, setting simple and understandable metrics and goals that are clear and understandable by everyone, creating our current HSE Management system 'Getting HSE Right' and by providing an increasing focus on our large contractor base that makes up over 50% of our workforce population worldwide. More recent success has been achieved by improving the reach, quality and competencies of safety leadership to better understand personal and safety risks to powerfully influence safe attitudes and behaviors among our workforce.

These and many other powerful interventions that have been put in place over the past 25 years have contributed to a much safe workforce today than ever before and are reflected in our latest injury frequency statistics in 2004. (Equivalent lost time injury rate of 0.40 and a total recordable injury rate of 2.6.)

## OUR COMMITMENT TO CONTINUOUS IMPROVEMENT

As our statistics suggest we have come a long way in safety and we are rightly proud of our achievements but as always in protecting our people from harm there is still more to do to keep those who work for us, with us and those that come into contact with our operations safe from harm. In safety we are always restless to improve while accidents still occur. As we look ahead to improve our future safety performance we plan to build on past successes by reinforcing current best practices as well as looking for internally and externally for new techniques and opportunities.

One of the distinctive achievements that has helped deliver our past successes has been our ability to learn from incidents and near misses to prevent similar incidents from occurring. Since the BP Amoco merger in 1999 we have improved our understanding of the causes of safety incidents and the application of the learning across our operation. However we are far from perfect in this discipline. Despite the improving application of learning from previous accidents there is still too much evidence of lessons not being learned and applied across our operation and many of what may be called 'repeat incidents' still occur. These constantly remind us that we have more to do to better understand the true learning from incidents, to better share the learning more widely and effectively and to institutionalize the learning from accidents in our own operations as well as from others in our industry. One could argue that in the petrochemical industry there are no

new hazards that surprise us when incidents occur, just our inability to learn the lessons from previous incidents and near misses.

## IMPROVING THE WAY WE LEARN AND EMBED LESSONS

To improve the way we learn from incidents and assure we improve the institutionalization of the learning in our day to day operations we have developed the 'virtuous learning cycle' model to identify the key elements of learning, our current strengths and opportunities to improve in the learning from incidents and near misses and the sharing of the lessons learned.

Traditionally in BP we have spent a considerable amount of time and resources on those learning and sharing activities on the right hand side of the virtuous learning cycle model and are confident that we now better at understanding the true causes of accidents inside our company. We have become somewhat effective in sharing the lessons with others however it is a fact that we have spent insufficient time and effort in the acting upon those lessons shared and institutionalising them in our day to day operations. In order to ensure improvement in each of the virtuous learning activities we have instituted a programme of improvement as follows.

### IMPROVING INCIDENT INVESTIGATION

Following the merger with Amoco in 1999 BP introduced a Group wide incident investigation system which contains a strict and comprehensive methodology to identify the

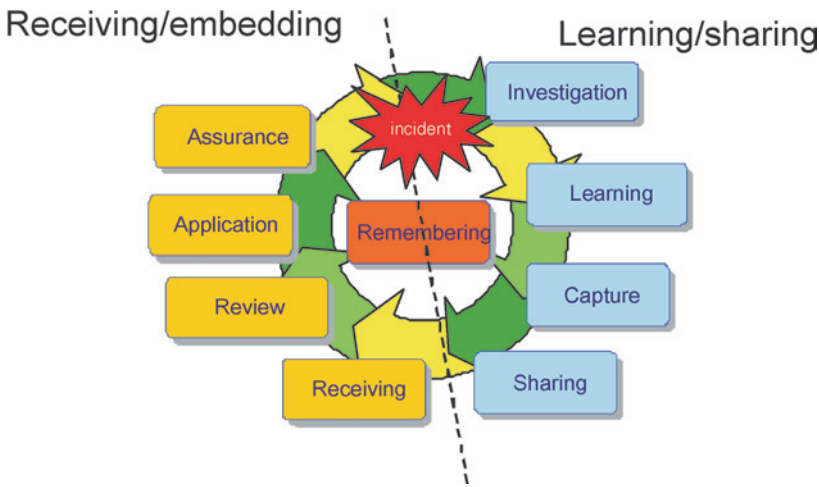


**Figure 2.** The BP Virtuous Learning Cycle

immediate and root causes and system failures behind all safety incidents. All incidents no matter how minor are investigated using the BP root cause technique and the application of our 'Comprehensive List of Causes' method. The Comprehensive List of Causes (CLC) is a root cause analysis technique that is a tool to assist investigators in determining the systematic causes of incidents. The CLC is designed for use in the analysis phase of an investigation.

The technique is applied in all parts of our operations worldwide using a common language and structure and in the more serious events such incidents involving fatalities these are investigated by a Business Unit Leader led team which includes an experienced root cause or system failure specialist. Since 1999 we have trained well over 2000 people across our global operations in the technique and have sustained competencies in the use of the technique by local 'train the trainer' programmes. We are very confident that the use of the root cause analysis technique has taken us a long way to where we are today by providing a common investigation and incident reporting protocol.

We have also identified the need to become better at understanding human error and human behavior. Many of our investigation reports have listed these as causes, but many times our analysis of such causes has stopped short of a full understanding of why human failure happened. In light of this, we have commissioned some work with a UK based industrial psychology consultancy to develop better insights into these two areas. Their understanding of human error and human behavior is of great interest to us and their application to incident investigation has led to the creation of a pilot training program in 2004 which we will rollout to our leaders and root cause analysts in 2005.

## CAPTURING THE LEARNING

While the incident investigation process has been very effective in determining what happened, where and when it happened and to some degree an understanding of why the incident occurred and what should be done to prevent a reoccurrence this knowledge was typically contained in a detailed investigation report, which was not an ideal medium for sharing lessons learned to other sites.

To make the sharing of lessons more meaningful and compelling we have created one page lessons learned documents that provide a quick overview as the details of the incident, including photographs and sketches, what the affected site is doing to ensure the potential for reoccurrence of the incident is minimized and proposed what actions should be carried out on other sites to avoid such an event from materializing.

## APPLYING THE LEARNING

### The BP Golden Rules of Safety

The BP Group policy has been to carry out root cause analysis for every fatal accident involving members of our workforce. We have also carried out root cause investigations on the majority of fatal incidents involving non-workforce or third parties. These investigations into these fatal incidents have identified common and repeat failures in our safety

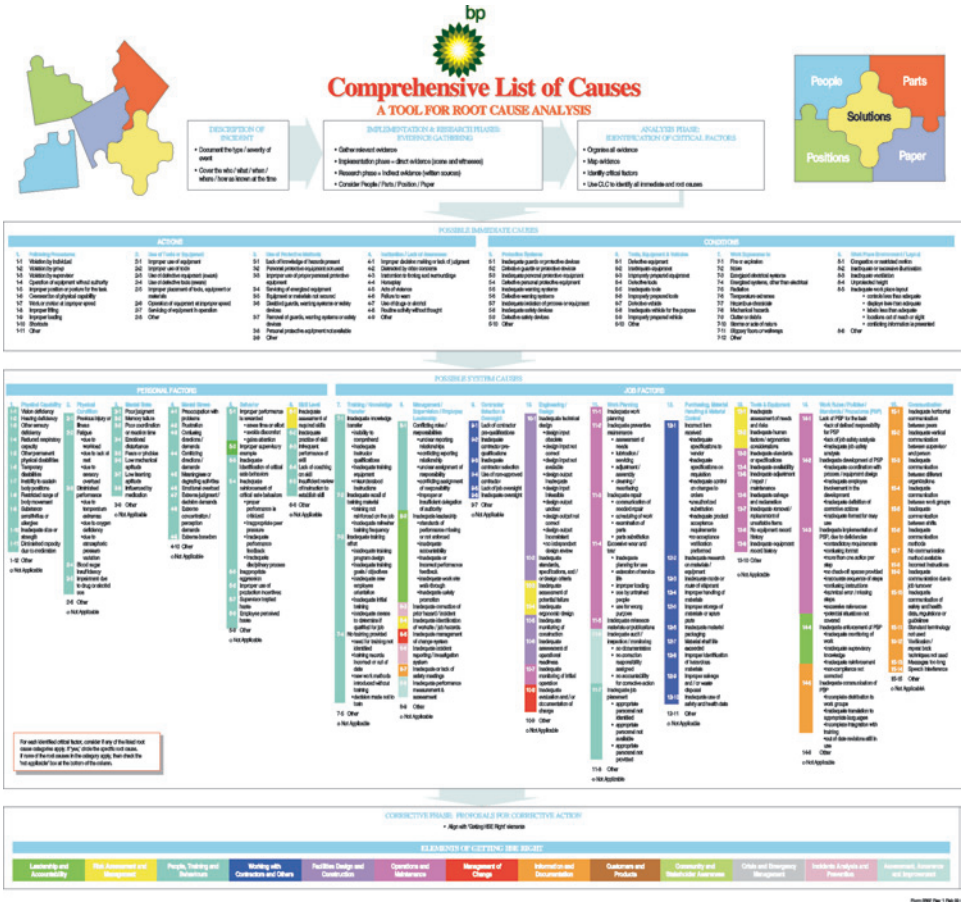


**Figure 3.** The BP Comprehensive List of Causes. A tool for investigators to help identify immediate causes of incidents and root or system failures

# Safety Lessons Learned

**Type of Incident:** Fall from Height, Fatality

**Business Unit:** BP Grangemouth

**Country:** United Kingdom

**Location of Incident:** Grangemouth Refinery

**Date of Incident:** 15th November 2001

**Brief Account of Incident:**

A contract welding supervisor fell over 9 metres to ground whilst descending from a fixed vertical hooped ladder.

The ladder was located on a Heater Unit and had been in service since 1969. The welding supervisor had been carrying out routine weld inspections in preparation for a plant turnaround, prior to descending the ladder to return to grade.

An eyewitness reported that the supervisor lost 3 point contact with the ladder and fell backwards through an unprotected section of ladder, hitting the handrail, pivoting over it and falling to grade. This vulnerable section of ladder between the top of the handrail and bottom of ladder guard hoops is highlighted in the photograph below.

Site first aid and medical personnel attended the supervisor at the scene before he was taken to the local hospital where he later died.

Reconstruction shows a POSSIBLE position at the location of incident

**Outcome:**
The injuries sustained in the fall resulted in the supervisor's death. He was 35 years of age and leaves behind a wife and three children.

**What went wrong:**

- The supervisor for reasons not determined did not maintain 3 point contact with the ladder
- There was no fall protection located between the bottom of the ladder guard hoops and the top of the handrails.
- The platform landing was of insufficient breadth to contain an individual in the event of a backwards fall from height
- This type of ladder is widespread throughout the complex and other like facilities and its use is standard custom and practice. The potential of a fall from the unprotected area between the bottom of the ladder guard hoop and the top of the handrail had not been foreseen for this location during more than 30 years of service.

**Lessons Learned:**

- Even when guards are in place they may not be sufficient to prevent injury
- Height is not the only consideration when assessing risk
- Design standards do not always reduce risk to an acceptable standard (as low as reasonably practicable)
- Risk can arise through even the most routine of activities
- Other related ladder incidents have occurred at the Grangemouth complex but lessons have not been applied consistently. After this accident, the site is even more committed to improve consistency of remedial actions across all operating areas in the complex.
- Safety rules for safe use of ladders have not been institutionalised across the complex. Greater emphasis, awareness and training will be given to everyday hazards, such as those identified in the use of ladders.

**Messages:**

- Even the most routine of activities involve hazards
- Basic occupational safety standards for older equipment should be equivalent to those expected on new plant
-

Ladders on Grangemouth Refinery Heater Unit

**Figure 4.** Sharing the learning across our operations – the one page lessons learned report

management system 'Getting HSE Right' The analysis helps us identify and understand which Elements of our safety management system have been found wanting and in need of improvement.

Our investigations of these accidents have also shown that in many cases simple procedures for controlling routine hazards during such activities were either not in place or were not being followed. To help better understand and manage safety hazards during these regular routine activities we gathered together good management practices into a set of simple guidelines. These have been titled the 'BP Golden Rules of Safety' which were piloted and tested for 3 years in our Exploration and Production segment in response to workforce fatalities and near misses across their worldwide operations. As a result of positive feedback and improving performance we have implemented them on a Group wide and global basis.

The BP Golden Rules of Safety focus specifically on 8 areas of safety concern in BP:

1. Permit to Work
2. Energy Isolation
3. Ground Disturbance
4. Confined Space Entry
5. Working at Heights
6. Lifting Operations
7. Driving Safety
8. Management of Change

The Golden rules identify current good safety practices and risk management and bring focus to areas where we believe we can make the greatest difference. Since we have applied these simple guiding principles of safety and ensure a rigorous follow up we have seen a dramatic reduction in fatalities across our operations. It is the accountability of leadership at all levels to ensure that their operations adequately address the Golden Rules of Safety and that the risk management actions become embedded throughout our operations. Also our analysis suggests that our major focus in the immediate term should be on the management of our contractors particularly in the areas of driving safety and the other Golden Rules.

The BP Golden Rules of Safety are currently being reviewed to ensure they currently address current occupational safety risks and are being further developed to create Group wide minimum mandatory Standards on such activities as Driving Safety and Control of Work.

The 'Sharing the Experience' Series

To help institutionalize lessons learned into operator training and to help raise awareness on essential safety learning BP has created a series of safety booklets and information packages under the title 'Safety, Sharing the Experience' that are used to develop awareness and competency. The Safety booklet series now contains 14 titles with more than 30,000 copies distributed over the past two years that have been translated into 5 major languages. These lessons learned booklets have been very well received across our

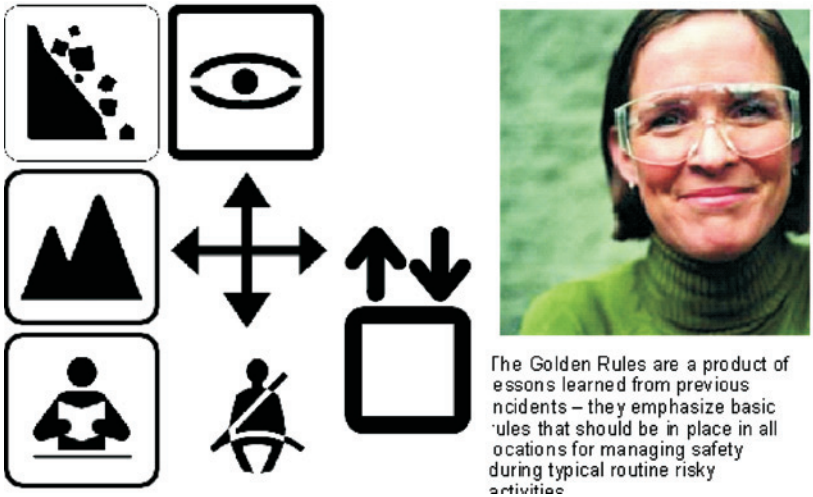


**Figure 5.** The BP Golden Rules of Safety


**Figure 6.** The latest BP Group Personal Safety Standards, Driving Safety and Control of Work. Both Standards contain the lessons learned from previous incidents and contain mandatory safety procedures for managing risks

operations worldwide and are very much in demand from external stakeholders. These booklets provide real value for operators, supervisors and engineers. Roy Sanders, the author of a book "Chemical Process Safety: Learning form Case Histories" has included the BP booklets in the section "The Best Seven Books on Chemical Process Safety from a Process Engineer's Viewpoint".

The Sharing the Experience booklet series now contains 14 titles and has been very well received worldwide. More than 30,000 copies have been distributed over the past two years and some titles had to be reprinted five times due to high demand. The 14 titles are as follows:

- Hazards of water
- Hazards of air and oxygen
- Safe furnace firing
- Safe ups and down for units
- Hazards of electricity & static electricity
- Hazards of steam
- Hazards of Nitrogen
- Hazards of trapped pressure/vacuum
- Tank farm & (un)loading safe operations
- Liquid Hydrocarbon Tank Fires: Prevention and response


**Figure 7.** The BP 'Sharing the Experience' safety booklets that contain specific learning from past incidents and near misses.

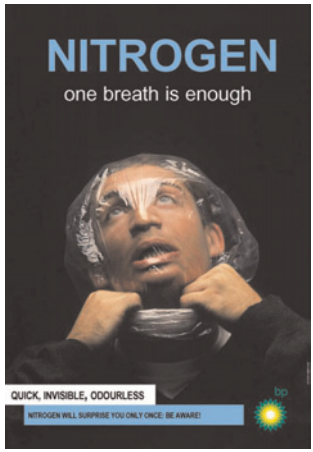


**Figure 8.** The Dangers of Nitrogen awareness pack

- Hotel Fire Safety
- Passive Fire Protection
- Fire Protective Clothing
- Halon alternatives

One particular information pack on Nitrogen hazards was prepared after the Group suffered 5 fatalities and 21 serious incidents over a 4 year period. Since the pack was distributed and the awareness elevated around the risk of nitrogen, the number of serious incidents involving this deadly gas has reduced remarkably. This awareness pack has been shared with other members of the petrochemical industry.

A similar information pack is currently being prepared to address Integrity Management risks across all BP operations.

## FOCUSING OUR COMMUNICATION

Sharing lessons learned and institutionalizing the learning from past incidents will help the organization to deliver our safety expectations. As a huge organization that has more than tripled size in the last 6 years to 110,000 employees from many heritage companies as well as over 150,000 contractors working daily in more than 100 countries, communicating the safety message and lessons learned effectively has been an increasing challenge. BP is therefore now focusing its efforts to improve the quality, relevance and timeliness of the routine incident information as well as improving the storage and accessibility of learning across the organization.


**Figure 9.** Sharing lessons across the Oil and Petrochemical Industry

## WORKING WITH OUR INDUSTRY

We realize that there is a huge potential in sharing more efficiently and more routinely with our industry partners to help prevent incidents from occurring across our industry.

Our commitment is to continue to work within our own operations and with our industry partners to improve the way we learn and share common lessons to prevent needless fatalities and injuries.

## CONCLUSION

As previously mentioned our incident investigations illustrate that we continue to repeat accidents, which indicates that the process of sharing lessons learned, and learning from lessons shared needs to be improved until we have irrefutable evidence that we no longer suffer repeats of life threatening incidents. Without effective learning from lessons from previous safety incidents we are doomed to repeat these incidents time and time again typically resulting in the loss of lives, limbs and livelihoods.

## APPENDIX: LESSONS LEARNING QUOTES FOR MEDITATION . . .

1. "It might seem to an outsider that industrial accidents occur because we do not know how to prevent them. In fact, they occur because we do not use the knowledge that is available." **Prof. Trevor Kletz**
2. "A wise man learns from his own experience, but a wiser man learns from the experience of others." **Author Unknown**
3. "There is nothing so easy to learn as experience and nothing so hard to apply." **Josh Billings (1818–1885)**
4. "Experience cannot be transformed. Though we might give wise advice, we cannot give the wisdom to follow it." **American Ladies Magazine May 1828**

5. "Good judgment comes from experience, and experience comes from bad judgment." **Barry LePatner**
6. "Experience is that marvelous thing that enables you to recognize a mistake when you make it again." **Franklin P. Jones**
7. "Experience is the name everyone gives to their mistakes." **Oscar Wilde (1854–1900), Lady Windermere's Fan, 1892, Act III**
8. "Human beings, who are almost unique in having the ability to learn from the experience of others, are also remarkable for their apparent disinclination to do so." **Douglas Adams (1952–2001), "Last Chance to See"**
9. "Idealism is what precedes experience; cynicism is what follows." **David T. Wolf (1943–)**
10. "Experience is a hard teacher because she gives the test first, the lesson afterwards." **Vernon Sanders Law**
11. "Experience teaches slowly and at the cost of mistakes." **James A. Froude (1818–1894)**
12. "Experience is something you don't get until just after you need it." **Olivier**
13. "Education is when you read the fine print. Experience is what you get if you don't." **Pete Seeger**
14. "Those who cannot remember the past are condemned to repeat it." **George Santayana (1863–1952), The Life of Reason, Volume 1, 1905**
15. "When anyone asks me how I can best describe my experience in nearly forty years at sea, I merely say, uneventful. Of course there have been winter gales, and storms and fog and the like. But in all my experience, I have never been in any accident. . . or any sort worth speaking about. I have seen but one vessel in distress in all my years at sea. I never saw a wreck and never have been wrecked nor was I ever in any predicament that threatened to end in disaster of any sort." **E. J. Smith, 1907**, (another (probable) famous quote from the same author in 1912, Captain, RMS Titanic: "is it a big leak?")
16. "Experience is what allows us to repeat our mistakes, only with more finesse!" **Derwood Fincher**
17. "Experience is what you get when you don't get what you want." **Dan Stanford**
18. "Experience is what causes a person to make new mistakes instead of old ones." **Author Unknown**
19. "Each experience through which we pass operates ultimately for our good. This is a correct attitude to adopt and we must be able to see it in that light." **Raymond Holliwell**
20. "We ought not to look back unless it is to derive useful lessons from past errors, and for the purpose of profiting by dear-brought experience." **George Washington (1732–1799)**
21. "If history repeats itself, and the unexpected always happens, how incapable must man be of learning from experience." **George Bernard Shaw (1856–1950)**
22. "The wise learn from the experience of others, and the creative know how to make a crumb of experience go a long way." **Eric Hoffer (1902–1983)**

23. "Mistakes are a part of being human. Appreciate your mistakes for what they are: precious life lessons that can only be learned the hard way. Unless it's a fatal mistake, which, at least, others can learn from." **Al Franken, "Oh, the Things I Know", 2002**
24. "Experience: that most brutal of teachers." **C.S. Lewis, Chicken Soup for the Soul (book)**
25. "Experience is a dear teacher, but fools will learn at no other." **Benjamin Franklin (1706–1790)**
26. "We learn from experience that men never learn anything from experience." **George Bernard Shaw (1856–1950)**
27. "The only difference between a genius and one of common capacity is that the former anticipates and explores what the latter accidentally hits upon; but even the man of genius himself more frequently employs the advantages that chance presents him; it is the lapidary who gives value to the diamond which the peasant has dug up without knowing its value." **Abbe Guillaume Raynal**