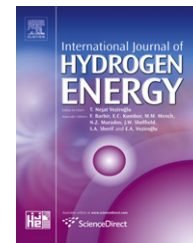


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Lessons learned from safety events

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ABSTRACT

The Hydrogen Incident Reporting and Lessons Learned website (www.h2incidents.org) was launched in 2006 as a database-driven resource for sharing lessons learned from hydrogen-related safety events to raise safety awareness and encourage knowledge-sharing. The development of this database, its first uses and subsequent enhancements have been described at the Second and Third International Conferences on Hydrogen Safety [1,2]. Since 2009, continuing work has not only highlighted the value of safety lessons learned, but enhanced how the database provides access to another safety knowledge tool, Hydrogen Safety Best Practices (<http://h2bestpractices.org>). Collaborations with the International Energy Agency (IEA) Hydrogen Implementing Agreement (HIA) Task 19 – Hydrogen Safety and others have enabled the database to capture safety event learning's from around the world. This paper updates recent progress, highlights the new “Lessons Learned Corner” as one means for knowledge-sharing and examines the broader potential for collecting, analyzing and using safety event information.

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1. Introduction

The primary purpose of safety event reporting, analysis and use is to facilitate the sharing of lessons learned and other relevant information gained from actual experiences, with the goal of preventing similar events from occurring in the future. As one example in the industrial sector, the Process Safety Incident Database (PSID) of the American Institute of Chemical Engineers' Center for Chemical Process Safety allows participating companies to collect and share safety incident experiences to enable learning based on the experience of others [3].

The magnitude of safety events can vary widely and impact personnel, equipment, business operations and the environment. By learning about the likelihood, severity, causal factors, setting and relevant circumstances of safety

events, one is better equipped to prevent similar incidents in the future and at other facilities.

These same principles have been applied to the development and use of a database-driven website, Hydrogen Incident Reporting and Lessons Learned (www.h2incidents.org). The development of this database, its first uses and subsequent enhancements were described at the Second International Conference on Hydrogen Safety (ICHS) [1]. At the Third ICHS, the lessons learned from three example safety events in the database were described and the linkage to specific resources in another safety knowledge tool, Hydrogen Safety Best Practices (<http://h2bestpractices.org>), was illustrated [2] (Fig. 1).

From the outset, we have hoped that users of this publicly accessed website will both learn valuable lessons from others and share their own experiences. Ensuring anonymity for

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H₂ Incident Reporting and Lessons Learned
About H₂Incidents | Advanced Search

Welcome!

Navigation ↗

Clear Find Records >>

Settings

- Laboratory (72)
- Fueling Station (20)
- Commercial Facility (17)
- Power Plant (15)
- Show All Options

Equipment

- Piping/Fittings/Valves (102)
- Hydrogen Storage Equipment (49)
- Vehicle & Fueling Systems (40)
- Safety Systems (25)
- Show All Options

Damage and Injuries

- Property Damage (110)
- None (82)
- Minor Injury (27)
- Lost Time Injury (18)
- Show All Options

Probable Causes

- Equipment Failure (83)
- Human Error (33)
- Design Flaw (28)
- Failure to Follow Standard Operating Procedures (20)
- Show All Options

What is H₂Incidents?

This database is supported by the U.S. Department of Energy. The safety event records have been contributed by a variety of global sources, including industrial, government and academic facilities.

H₂Incidents is a database-driven website intended to facilitate the sharing of lessons learned and other relevant information gained from actual experiences using and working with hydrogen. The database also serves as a voluntary reporting tool for capturing records of events involving either hydrogen or hydrogen-related technologies.

The focus of the database is on characterization of hydrogen-related incidents and near-misses, and ensuing lessons learned from those events. All identifying information, including names of companies or organizations, locations, and the like, is removed to ensure confidentiality and to encourage the unconstrained future reporting of events as they occur.

More About H₂Incidents...

How does H₂Incidents work?

You can access incident reports on H₂Incidents in a number of different ways. Here on the home page, you can go directly to the latest posted incidents using the navigation in the box to the right labeled "Latest Reports." The bottom of this box also contains a total for the number of incident reports in the system. By clicking the "show all" text next to this number, you can view a complete, alphabetical list of incidents.

To look for incidents related to specific details, you can use the left navigation. The five main headings—Settings, Equipment, Damage and Injuries, Probable Causes, Contributing Factors—will help you drill through the collection of incidents to find those that interest you. To see a graphical representation of the number of incidents associated with each of these main headings, simply click on the heading and then mouse over the chart to view a larger image. At any time, you can also use the Advanced Search form, found at the top of the page, for some more options to search the database.

If you have an incident you would like to include in the H₂Incidents database, please visit the Submit an Incident page. This page will ask for a wide range of information on your incident. Please enter as much of the information as possible. In order to protect your and your employer's identities, information that may distinguish an incident (your contact information, your company's name, the location of the incident, etc.) will not be displayed in the incident reports on H₂Incidents.

Submit an Incident

Latest Reports

- Lithium Aluminum Hydride Laboratory Fire
- Organic Vapor Ignites When Hydride Decomposes in Air

TOTAL EVENTS REPORTED: 206 (SHOW ALL)

New! Lessons Learned Corner

- Hydrogen Compatibility of Materials
- Learning from Burst Disk Failures

LESSONS LEARNED ARCHIVES

Fig. 1 – Hydrogen incident reporting and lessons learned database welcome page.

those who submit safety event records is an important principle in this work. Therefore, all identifying information, including the names of companies or organizations, locations, equipment brands and the like, are removed to ensure confidentiality and to encourage the unconstrained future reporting of events. Adherence to this approach will help ensure the future viability of this tool and enable additional enhancements such as the one which is the principal topic of this paper.

2. Enhancing "H₂incidents.org"

Our goal has always been to ensure technically accurate safety event records. Over the past three years, we have made significant technical enhancements to the safety event records stored in the database, which currently contains 206 records. The 114 safety event records entered during 2006 and 2007 were mainly obtained from databases and journal articles, many of which were from the 1980s and even earlier. Only about 25% of these incidents occurred since 2000, and about 40% of them occurred in the 1990s. For most of the initial efforts to collect lessons learned, the information that could be extracted directly from the database sources and other documents was limited. Access to points of contact for detailed discussions of these events, their probable causes, contributing factors and lessons learned was also significantly

limited. As would be expected for growing hydrogen-related research and development (R&D) and applications, hydrogen safety best practices have evolved to an enhanced state of knowledge compared to 30–40 years ago, and these early incidents may be less relevant to current hydrogen-related work.

Among the 92 safety event records entered into the database since 2008, about 85% occurred between 2001 and the present, making those lessons learned more relevant to those who are working with hydrogen today. Recent safety events were brought to our attention by organizations such as the U.S. Department of Energy (DOE) and the Fuel Cell and Hydrogen Energy Association (FCHEA), through Google alerts searching for "hydrogen" or "fuel cell vehicle" stories in the news media and through self-reporting.

The inclusion of international hydrogen safety event records has also greatly enriched the database content and expanded the pool of lessons learned information. A collaboration with members of the IEA HIA Task 19, including Canada, France, Germany, Italy, Japan, the Netherlands, Switzerland, the United Kingdom and the United States, added safety event records to our database during 2009 and 2010.

We continue to work with "incident owners" to obtain complete and accurate descriptions of the safety event and lessons learned, photos that might enhance the knowledge-sharing process, and final approval of the record. All identifying information (e.g., individual and organization names,

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