On Track to Safety:

Risk Assessment of a Hobby

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Being asked to assess the risk of a favorite hobby can be a delight—particularly to an occupational safety researcher who finds joy in seeing the boundaries between work and leisure disappear. This is what happened to the author when the board of executive directors of the Montreal Live Steamers Corp. suggested a project inspired by "Health and Safety at Work Act: The Model Engineer's Perspective," an article in *Model Engineer* (Harrison, Clifton and Williams 744+). This article reviewed a complete risk assessment produced for a British club of live steamers.

For those unfamiliar with this hobby, it entails laying down model track (usually 3½", 4¾" or 7¼" wide) and running miniature trains along it. The track of the author's local club is about one kilometer long. What makes this activity particularly interesting is that most of the locomotives are steam-powered (hence the nickname "live steamer") and trains can carry people (photo above).

Obviously, safety is a concern in this setting. Like most live steamer clubs, members love to share their hobby with

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others. Thus, it is important to ensure that no mishaps occur and that no one is injured. Through the risk assessment project, the club set out to create—and sustain—an improved safety culture.

THE RISK ASSESSMENT PROJECT

A literature review was the first step. This encompassed club regulations, local laws and regulations and machine safety standards. In addition, a five-member safety committee was created; an engineering student also participated to provide an external perspective. To facilitate the project, risk assessment forms and an event report were created (Tables 1 and 2). Using these documents, the safety committee learned how to conduct a risk assessment and collect information.

Since most risk assessments begin with the identification of hazards, the safety committee observed the track site—both as a group and individually—at the beginning of the 1999 season. These observations were particularly intensive during the international meeting, held the first weekend in July, because this event draws many other hobbyists and members of the public.

The committee also reviewed all forms completed following any "abnormal event." This systematic collection of data offered a snapshot of what really occurred on and around the tracks; these forms confirmed or completed the hazard identification process. Club members were very cooperative in this effort—reporting all abnormal events, whether the consequences seemed meaningful or not.

Based on findings of the hazard iden-

TABLE 1 General Form for Risk Assessment

Safety Committee		*Montréal Live Steamers Corp.—Event Evaluation Form*								
No.	Location	Hazardous situation and/or cause(s)	Remarks	Risk evaluation				Priority	Means or devices to reduce risk level	Selected preventive measures
				Severity (S1/S2)	Frequency/ exposure (F1/F2)	Avoidance possibility (P1/P2)	Level (0 to 4)			
A	**Hazard description: Train derailing**									
A.1	Tracks	Bad quality of tracks. The driver cannot know track defaults or drives too fast for them.	There is currently a loop that must be taken at low speed because of poor track.	S2	F2	P1	3	1	Production and application of standards for track maintenance (quality standards).	Urgent work on tracks at the identified location.
A.3	Tracks	Bad quality of suspension of cars. Cars are prone to overturn and derail.	Some cars derail often and others do not.	S2	F2	P2	4	2	Identify and modify suspension of unstable cars.	Work on the identified cars.
A.4	Tracks	Passenger who unbalances train. Mainly kids who move or videotaping adults.	During international meeting, the station master gave safety directives.	S2	F1	P1	1	1	Awareness of passengers and drivers to this hazard.	Emphasis on instruction to passengers and add warning posters at the station.
D	**Hazard description: Collision between a vehicle and a train running on track**									
D.2	Entrance crossing	The first road crossing is the most-critical of the three because it is near club entrance (close to road).	Crossings are well indicated (stop signals and yellow and black ground tape).	S2	F1	P1	1	1	A better signalization could help.	Paint and add signalization for trains and cars at crossing.
H	**Hazard description: Object able to hurt train passengers**									
H.2	Tracks	Passengers (kids) grabbing objects at the sides of the tracks.	At this time, the club does not present this type of hazard but this must be assessed.	S2	F2	P2	4	3	Remove objects that could be grabbed on each side of the tracks.	Check regularly that no trees grow too close to the track.

TABLE 2 Event Report

EX20-52	***Montréal Live Steamers Corp.—Report of event***							
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Reported by:		Report date:		Report number				
Date of event:		Location of event (show on map if possible)						
Event hour:		Concerned track:	7¼":	5":	4¾":	3½":		
Detailed description of the event:								
Type of event:	Derailment:		Turn over:		Collision:		Other:	
Consequence(s) of the event:	Body wound:		Material:		None:		Other:	
Affected people(s):	MLS member:		MLS member family:		Public:		Visitor of other club or family:	
	Name(s):			Onboard:	Non onboard:	Received treatment:		
Activity in process:	Train circulation on main line:	Train circulation in station:	Passenger(s) loading/unloading:	Running equipment loading/ unloading/ storing	Initial or final locomotive preparation	Car circulation:	Foot circulation:	Maintenance or construction works:
Event having induced the wound or misshape:								
Preceding cause(s):								
Other causal agent(s):								
Proposed prevention mean(s):								
Remarks:								

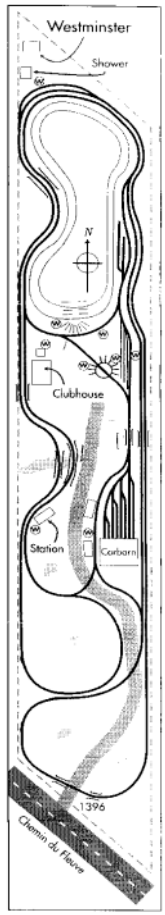
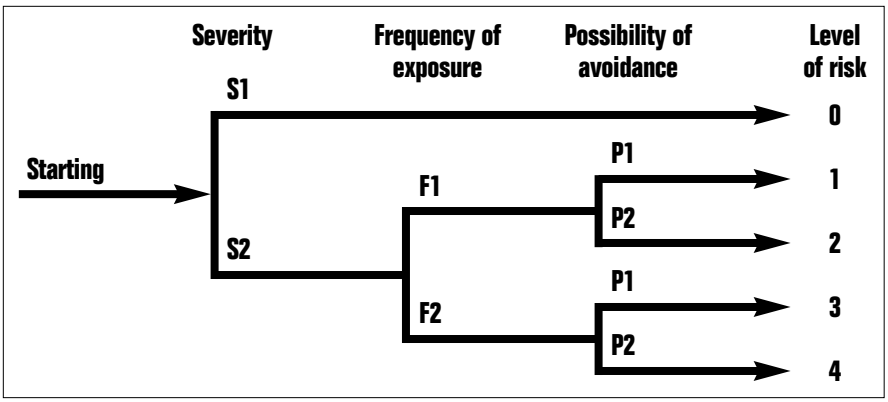


FIGURE 1 Risk Graph



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tification phase, the committee proceeded to identify causes, estimate the associated level of risk and define priorities for preventive action. The complete assessment was developed during several working meetings of the safety committee. The engineering student then prepared a list of all identified risks in any foreseeable situation (e.g., loading or unloading equipment, running in private or public operation, maintenance).

Nine main hazard domains were identified and analyzed:

1) train derailment;
2) collision between:
   - a car and a person;
   - two vehicles on the club site;
   - a vehicle and a running train;
   - a train and person (club member or visitor);
   - two trains;
3) objects able to injure train passengers or emergency unloading of cars;
4) burning by steam jet or wounds by missile parts from steam locomotive;
5) contact with burning coal or cinders from a steam locomotive;
6) hazards associated with propane firing;
7) hazards associated with fuel (motor-driven locomotives);
8) hazards associated with unloading/loading equipment, including back pain;
9) miscellaneous concerns:
   - respiratory problems for train passengers;
   - air compressor in the equipment service building;
   - electrical hazard during battery charging in service building;
   - injuries from unattended tools.

THE RISK ASSESSMENT TOOL

The risk assessment relied on definitions from standards related to "hazardous situation," severity of consequences, frequency or duration of exposure to a hazard and ability to avoid the harm's source. The

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prevention strategy used the same preference order as in "real life":

1) Reduce the risk via construction (design) or operational procedure.

2) Use protective measures or reduce access to the hazard.

3) Warn all involved of the hazard.

For any detailed hazard within the nine domains, a risk level was defined using a risk graph that mapped three key parameters (Figure 1):

- severity of consequences (S1: slight injury or first help or S2: any other harm);
- frequency of exposure (F1: low frequency or exposure or F2: often);
- ability to avoid (P1: possible under certain conditions or P2: nearly impossible).

This simple method emulates those used in industry. Based on risk level, a priority level was established for corrective action, taking into consideration ease of implementation and current practice.

RISK ASSESSMENT RESULTS

Based on preliminary hazard identification, some immediate actions were taken. In addition, a full report that included both short- and long-term recommendations was prepared. For each hazard identified, the safety committee defined a prevention strategy or reviewed the club's current preventive measures. Recommendations ranged from no change to equipment modification, and from additional construction to specific training (club members) and information designed to educate visitors. In many cases, the club's current practices were recognized as appropriate, with associated risks being deemed "tolerable."

Based on recommendations, more warning posters were displayed throughout the club site to better inform visitors about hazards related to the circulation of trains drawn by steam locomotives. In addition, access to some areas was restricted. Several regulations have been modified as well, and new ones (e.g., a new boiler test procedure) developed to address identified hazards.

Since the assessment was performed and preventive measures were implemented, the number of abnormal events has decreased. Despite these positive results, the safety committee continues to seek improvements. As in any plant or office setting, this will require the continued support and input of club members. ■

REFERENCES

American National Standards Institute (ANSI). "Risk Assessment and Reduction: A Guideline to Estimate, Evaluate and Reduce Risks Associated with Machine Tools." ANSI Technical Report for Machine Tools, B11.TR3. New York: ANSI, 2000.

Australian Miniature Boiler Safety Committee (AMBSC). "Copper Boilers." AMBSC Code Part 1. New South Wales, Australia: AMBSC, 1994.

Bell, W.S. "Model Steam Trains Generating Regulations." *Live Steam Magazine.* Sept./Oct. 1993: 46-49.

Chesapeake & Allegheny Steam Preservation Society. "Boiler Testing Rules and Regulations. Baltimore: Chesapeake & Allegheny Steam Preservation Society, 1998.

European Committee for Electrotechnical Standardization (CEN-CENELEC). "Machine Safety: Control System Safety-Related Parts (Part 1): General Design Principles." EN 954-1, 1998.

Golden Gate Live Steamers Inc. "Safety and Operating Rules." San Francisco: Golden Gate Live Steamers Inc., 1995.

Harrison, B., J. Clifton and T. Williams. "Health and Safety at Work Act: The Model Engineer's Perspective." *Model Engineer.* June 19, 1998: 744-745.

Harrison, B., et al. "Risk Assessment for Model Engineering Societies: Part Two." *Model Engineer.* July 3, 1998: 18-19.

Health and Safety Executive (HSE). Entertainment Sheet No. XX (working document). Caerphilly, England: HSE, 1998.

International Organization for Standardization (ISO). "Machine Safety: Basic Concepts, General Design Principles (Part 1): Basic Terminology, Methodology." ISO/TR 12100-1. Geneva, Switzerland: ISO, 1999.

ISO. "Machine Safety: Principles for Risk Assessment." ISO 14121. Geneva, Switzerland: ISO, 1999.

Canadian Standards Assn. (CSA). "Requirements and Guide for Risk Analysis." ACN/CSA-Q634-91. Toronto, Ontario: CSA, 1991.

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