## Lessons Learned

### *Preventing Accidents during Turbine Inspection and Repair*

*Editor's Note: When accidents, errors, or omissions occur, they are, at best, embarrassing. At worst, they can result in suffering and major loss. However, reviewing these can be valuable. That's what this new department is all about — learning from past mistakes. James L. Gordon, B.Sc., hydropower consultant from Quebec, Canada, will serve as editor, calling upon his more than 40 years of design experience on hydropower projects throughout the world.* — M.B.

It is wise to be especially vigilant during inspection and/or repairs at hydro facilities, to prevent accidents.

I remember on one occasion an intrepid engineer had partly squeezed his way through the stay vanes and wicket gates of a vertical shaft propeller unit just far enough to check the clearance at the runner blades. He extricated himself from this awkward position with some difficulty and then crouched down in the scroll case to record the measurements, when to his consternation the wicket gates rapidly closed! After recovering, and climbing out to the generator floor level, he found the plant operator showing the governor to a visitor, unaware of what had just happened below.

On another occasion, a turbine was under repair. The spiral case manhole cover had been removed. Because leakage through the upstream butterfly valve was too great for the spiral case drain, the wicket gates were opened. As reported in the utility's in-house magazine, "Maintenance men who were preparing to check repairs to a valve controlling water flow to the turbine operated the governor's wheel in manual mode (to open the wicket gates). This closed a switch mounted on the governor that energized the solenoid valve and allowed oil pressure to flow to the main valve. This, in turn, caused the valve to open, and water flowed toward the machine. The water escaped under pressure through an open manhole cover. The force of 100 psi caused the water to burst through the roof. Fortunately, no injuries occurred." The plant was back in service nine days later.

**The lesson learned:** when working on a unit, all controls should be blocked and locked. Keys should be kept by the repair-inspection team leader until work is completed, and only then returned to the regular operators. Now, whenever I enter a spiral casing, I make certain that not only is the governor pressure system off and the wicket gates blocked, but also that headgates and turbine valves are completely inoperative. A detailed safety check procedure, which is rigorously followed when entering an "enclosed space," is an important tool to help prevent accidents.

*— By James L. Gordon*