CASOM 1: HIGH IMPACT LOW PROBABILITY (HILP) REDUCTION PROGRAMME

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BACKGROUND

Within ESB a High Impact Low Probability Event has become known as a HILP. By definition HILPs occur infrequently but have a high impact in terms of outage duration and/or cost. In 1992, ESB was an island utility of approximately 4000 MW, with no interconnection to other systems. Seven large generating units ranging in capacity from 250 MW to 305 MW made up almost 50% of the generating capacity. A one-year outage on one of these units could reduce the system availability by 6% to 7.5%. The occurrence of a HILP on one of these units could cause cancellation of a planned outage or threaten the ability to provide a reliable service.

Prior to 1992, ESB had experienced a considerable number of HILPs. In one year, the impact on availability was 4%. The need to take action to reduce HILPs was recognised, but the task was deemed daunting. When a transformer on one of the large units failed in 1992 (resulting in a 9 month outage) it was decided to "grasp the nettle" and take action.

DATA COLLECTION AND ANALYSIS

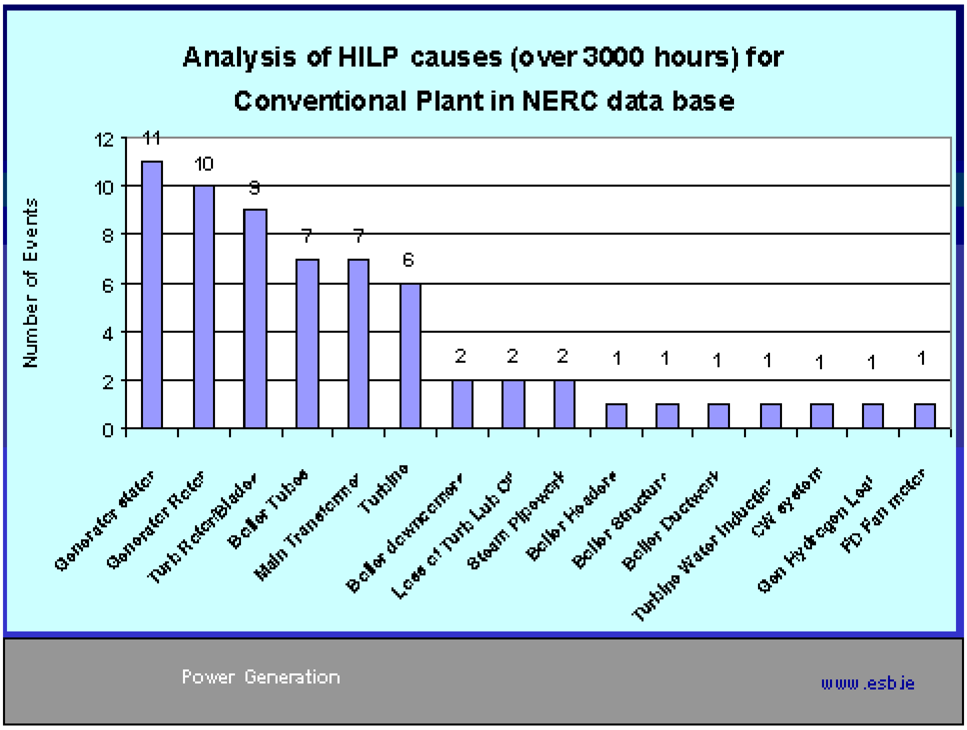
ESB commissioned NERC (North American Electric Reliability Council) to create a database of HILPs from their GADS database. NERC produced a list of events which resulted in outages of over 1000 hours from their database of over 5000 units.
The database identified:

- The type of forced outage;
- Start and end dates/ times;
- Duration of event;
- Cause code; and
- A short description of what caused the event.

From this database ESB produced the above list of causes of HILP with durations of over 3000 hours. This was used to prioritise the risks to be addressed. The study indicated that the average HILP frequency in the NERC database was one HILP (of 3000 hours outage duration) every 70 unit-years. ESB subsequently defined a HILP as:

- An unplanned outage of 3 months on any unit;
- A significant environmental incident;
- An incident which could cause loss of income greater than 10% for the particular generating station.

Using the database, and adding the experience of ESB specialists, a list of 80 potential causes of HILPs was drawn up. These were then prioritised and an action programme drawn up.



APPLICATIONS AND PROCESS

A failure Modes and Effects Analysis was drawn up for each HILP by the appropriate ESB plant specialist. Only those modes which could potentially cause a HILP were listed. For each mode, a list of actions was drawn up which could:

- Reduce the probability (Prevention);
- Provide early warning (Detection);
- Reduce impact or duration of outage (Mitigation).

Some of the actions listed required large expenditure (e.g. purchase costly spares). Other actions could be easily implemented (e.g. revise operating instructions, install an alarm). All actions were divided into the following 3 categories:

- Short Term - Those which could be implemented immediately;
- Medium Term - Those which could be implemented within a year;
- Long Term – Those which required considerable resources and could not be done immediately.

SUCCESS STORY

On 16 March 1994, a sacrificial anode on a condenser became detached from the tube plate in the condenser water box. As it had been fixed through the tube plate, it left a hole about 12 mm (half inch) in diameter and resulted in a large quantity of seawater entering the hot well. If the estuarine water had entered the boiler, a long outage could have resulted with possible need for a chemical cleaning costing in excess of US$1million. A "Massive condenser leak" had been identified as a potential HILP. A condensate conductivity trip had been installed under the heading of "detection" during the HILPs programme. The action taken (under the heading "mitigation") was to trip the extraction pump. The unit was taken off load before a large influx of contaminated condensate could enter the boiler. A prolonged outage and possible need for acid wash were avoided.

References:

Gerard Caffrey; Thomas Hanson, Electricity Supply Board, Dublin, Ireland and Ronald J. Niebo; Michael Curley, North American Electric Reliability Council, Princeton New Jersey, USA, *Minimising High Impact Low-Probability Forced Outages,* published PWR-Vol. 28 1995, Joint Generation Conference, Volume 3 ASME 1995.