Nuclear Property Insurance Fire Loss Experience Associated With The Global Nuclear Industry[1]

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ABSTRACT

This paper provides insights into the fires that have occurred at nuclear facilities insured through nuclear insurance pools, using property insurance loss experience developed over 30 years. Insurance companies have a large financial stake in the successful efforts of nuclear complexes to minimize nuclear insurance losses, including the potential for fires and ensuing consequential damages caused by fires. There are substantial monetary assets at risk. To ensure that the insurance risk is properly underwritten, insurance companies continually analyze loss information for the purpose of focusing loss control activities, establishing insurance policy conditions and gathering insurance capacity.

The paper presents the results of an in depth analysis of worldwide nuclear property insurance loss experience with respect to fire losses at nuclear power plants. Of the more than 600 property insurance losses between 1966 and 2000, approximately one fourth are caused by fires, with insurance losses exceeding US 50 million dollars. The analysis includes loss statistics of fire losses that occurred in both nuclear and non-nuclear (balance-of-plant) systems, structures and components, all of which are analyzed to identify relationships with respect to fire losses. Nuclear plant aging in relation to fire loss statistics is also presented.

INTRODUCTION

The paper presents the results of an in depth analysis of worldwide nuclear property insurance loss experience with respect to fire losses at nuclear power plants. Of the more than 600 property insurance losses between 1966 and 2000, approximately one fourth are caused by fires, with insurance losses exceeding US 50 million dollars. The analysis includes loss statistics of fire losses that occurred in both nuclear and non-nuclear (balance-of-plant) systems, structures and components, all of which are analyzed to identify relationships with respect to fire losses. Nuclear plant aging in relation to fire loss statistics is also presented.

In what follows, we first present the monetary stake that ANI has with respect to assets at risk. Statistics of insurance loss frequency and monetary damage from 1966 through 2000 are then summarized by cause of loss, buildings, systems and components damaged. This is followed by an analysis of insurance losses with respect to nuclear plant aging.

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[1] Presented at Fire & Safety 2001, London, England, February 2001

INSURANCE ASSETS AT RISK

ANI “pools” the assets pledged by member insurance companies to provide financial protection to the nuclear industry. Through insurance, broad financial protection is provided to cover the nuclear liability and property damage exposures of nuclear utilities and other businesses that support nuclear utility operations. In the aggregate, ANI issues over 1,100 nuclear insurance policies to the US nuclear industry at more than 400 locations. Combined, these facilities produce more than 300 gigawatts of electricity. ANI also participates in reinsurance of non-US nuclear plants and other nuclear facilities worldwide.

ANI provides nuclear liability insurance of US $200 million in financial protection to each US nuclear power plant. This protection covers the operators of nuclear facilities and their suppliers for legal liability for damages because of bodily injury or off site property damage caused by the nuclear energy hazard.

ANI also provides reinsurance capacity to support insurers worldwide. Reinsurance is generally assumed on a facultative basis. ANI reinsures approximately 68% of the over 400 nuclear power units operating in 31 countries outside the USA. ANI also writes up to US $25 million of direct liability coverage for US suppliers of products or services to nuclear facilities outside the USA.

Policyholder claims from fire losses typically seek reimbursement for the costs associated with direct property damages to the item that has failed as well as related damages, such as onsite contamination cleanup, both radiological and non-radiological, and damage to adjacent equipment and structures from missiles and smoke. In the aggregate, a single fire can produce a substantial claim. Final settlement of the claim is referred to as an "insurance loss.”

DISCUSSION

A prime concern for an insurer is predicting whether present design, operation, maintenance and fire protection strategies will effectively minimize the likelihood of fires at nuclear power plant facilities. A higher likelihood of fire loss creates an increase in insurance exposure. Normally, this increase in insurance exposure can be assuaged by increasing the spread of risk or reducing the insurance risk through loss control strategies. There are several methods to address the spread of risk. In this instance, we consider a reasonable spread to be a mix between well operated and maintained reactors and others. Economic pressures to reduce operating and maintenance expenditures, combined with no new nuclear plants, has the effect of decreasing the spread of risk, thereby increasing the insurance risk.

From a business perspective, ANI must be reasonably assured that the insurance risk from fire does not disproportionately increase the underwritten insurance risk. A departure from this view would almost certainly result in an unfavorable business climate both for ANI and its customers. Therefore, we quantify insurance exposure to develop underwriting and loss control strategies.

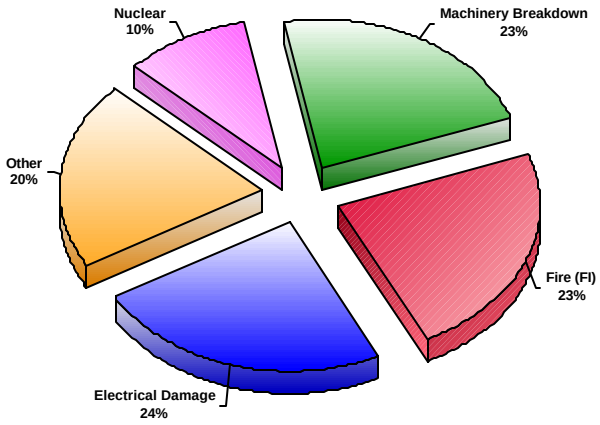
Independent of industry research and experience, an analysis of insurance loss data reported to a proprietary insurance data base was undertaken. The data base, referred to as the Global Loss Data Base (GLDB), represents the collected property loss history of all nuclear plant insurance losses reported to the commercial nuclear insurance pool system.

For reference, the loss statistics that follow reflect monetary losses in excess of the policy deductibles and range from approximately US $41,000 to more than US $100 million. The losses have been inflation adjusted to 2000 US dollars. Excluded are business interruption losses which are insurance losses resulting from the loss of revenue due to the inability of the damaged facility to generate electricity.

- Losses by Peril -

Nuclear Property Insurance losses are classified into five peril types, which are often referred to as "cause of loss." The five peril types are: Electrical Damage, Fire, Machinery Breakdown, Nuclear and Other. Figure 1 below illustrates the distribution of paid losses with respect to each peril type.

Figure 1 - Number of Property Losses by Peril (1966-2000)



Fire losses account for 23 percent of the total number of the nuclear insurance loss history. Individually, the most costly losses are in the Machinery Breakdown and Fire areas, resulting in loss statistics (risk of an insurance loss) that can be approximately two to four times those in the categories of Nuclear, Electrical and Other. The average fire loss is approximately US 1.2 million dollars.

Combined experience and data indicate that fire is a significant hazard at nuclear power plants. Moreover, many fires are the result of mechanical (Machinery Breakdown) failures of large equipment, such as main turbines and main generators. There are five major fire events which were the result of mechanical failures of this equipment.

In evaluating plant age at time of loss, we find that the highest probability of loss for plants less than 10 years old is equally shared in the Fire and Electrical Damage areas. Nuclear losses tend to occur later in plant life, while the likelihood of Machinery Breakdown losses tend to occur equally throughout plant life.

- Fire Losses by Building -

For statistical purposes, losses are segregated into 11 buildings on a nuclear site. Figure 2 provides a summary of the loss history with respect to each of the eleven building classifications. The building category "other" includes fire losses that occurred in areas outside the plant, but on the grounds of the facility. With respect to a single building, the largest number of losses involves the turbine building, closely followed by losses classified as "other."

Figure 2 - Property Losses by Building (1966-2000)

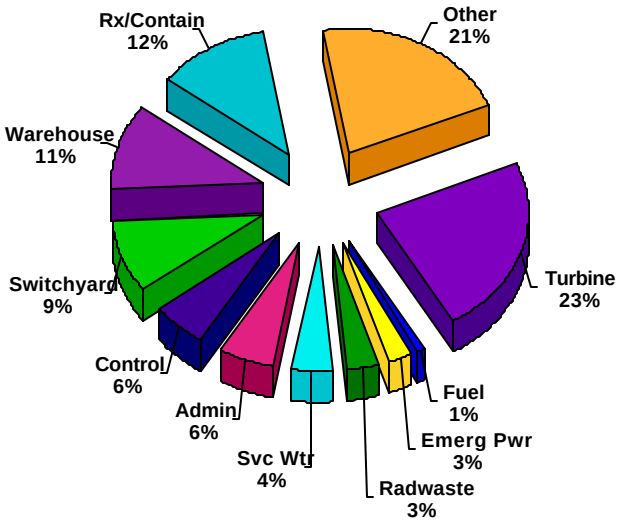


Table I below summarizes for each building classification the average loss amount expressed as a percent with respect to the total loss amount for the category of "fire." The highest average losses are associated with the turbine building and switchyards. The average turbine building loss totaled approximately US $3 million.

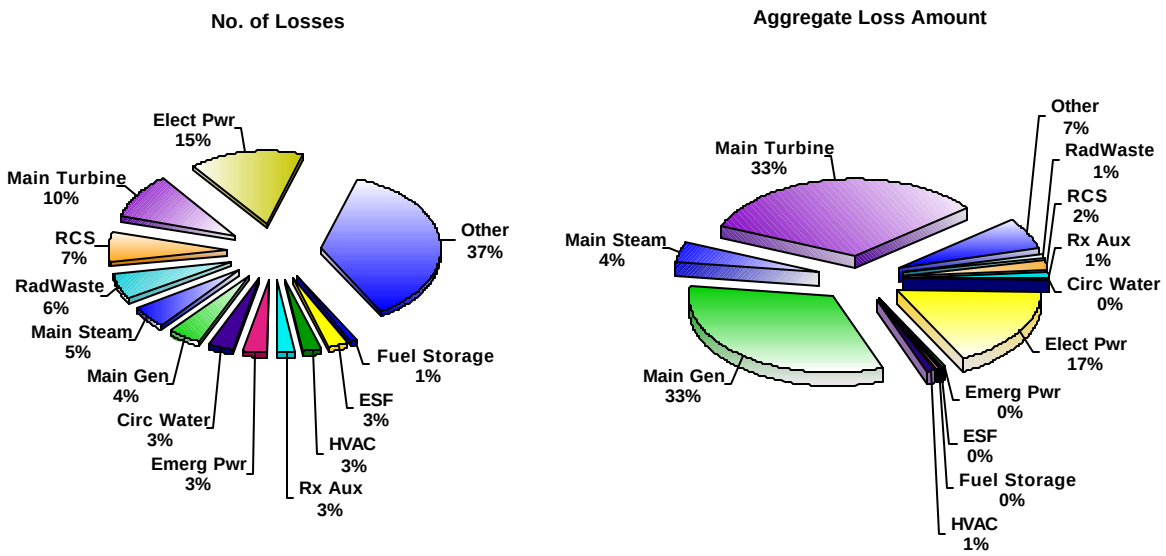
Table I
Losses Summarized by Building
(Percent of Total 2000 US Dollars)

Building	% of Total Loss History
Turbine	60%
Switchyard	21%
Maintenance/Warehouse/Laboratory	5%
Other	5%
Reactor/Containment	5%
Control/Switchgear/Electrical	1%
Emergency on-site power	1%
Radwaste	1%
Administration	< 1%
Circulating/Essential Service Water	< 1%
Fuel	< 1%

- Fire Losses by System -

Losses are additionally classified into 13 systems within each of the eleven building categories. Figure 3 provides a summary of the loss history with respect to each of the thirteen systems. With respect to a single system, the largest number of losses are associated with systems outside the main plant, closely followed by the Operational Electrical Power system. The most costly individual losses occurred in the Main Turbine and Main Generator/Generator Support Systems, with the average loss totaling over US $5 million for each.

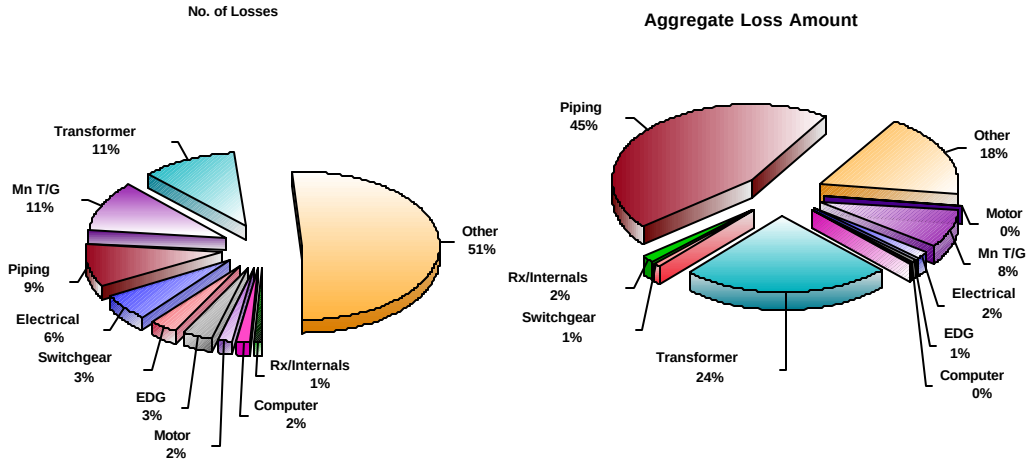
Figure 3 - Fire Losses by System (1966-2000)



- Fire Losses by Component -

Losses are further classified into 10 component categories. Figure 4 summarizes the loss history with respect to each of the ten component categories. The largest number of losses was associated with components located in areas outside the plant although the average loss in this category is relatively small. Losses in the "other" category include such things as security, outside warehouses, material handling components, water treatment and meteorological equipment. The greatest monetary impact is associated with fires that damaged piping and transformers, with an average loss of approximately US $5 million and US $2 million respectively. Individually, losses associated with transformers and oil fires are the most expensive.

Figure 4 - Fire Losses by Component (1966-2000)



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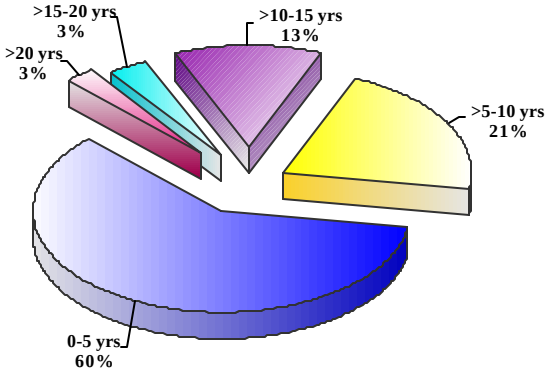
Losses with Respect to Plant Age -

Monetary losses with respect to plant age were also evaluated to determine possible trends. Figure 5 groups reactor plants by age and provides the percent of total insurance losses for each group. This representation shows that few plants experienced losses late in life. The vast majority of losses occur early in plant life. The average plant age at time of fire loss is approximately 6 years.

Figure 5 - Number of Losses vs Plant Age (1966-2000)



CONCLUSION

Nuclear insurance loss control experience combined with insurance loss data indicates that fire is a significant insurance risk at nuclear power plants. We note also that many fires are the result of mechanical (Machinery Breakdown) failures. Failures of large equipment, such as main turbines and main generators, can cause significantly large fires, as exemplified by the five major fire events that have occurred throughout the commercial nuclear industry.