Chapter 9 Recommendations for Future Work

9.1 Introduction

This chapter is included to summarise the areas of further research which have been highlighted through the work carried out for this thesis. While the studies have been successful in addressing the problems discussed in Chapter 1, further investigations are required to address the other aspects of the risk management process, or indeed the other techniques used for risk analysis. The relevant areas have been derived based on the prospect of significant improvement in a particular area of work which is outwith the scope of the original research programme. The views presented are the personal opinion of the author and are based on the future development and enhancement of the risk management process. The future studies are presented as a list of possible investigations.

9.2 Future Research

- This particular idea for future research stems from conclusion 3 from section 8.4. The traceability of data used in QRA is seriously awry. This problem requires to be remedied as each installation's safety case is required, by law, to be re-submitted every three years. This data is also used for safety upgrades amongst other things and is used by many different personnel. Therefore, if any revisions are necessary or the data requires updating, the source of the original data is essential. One possible solution is to produce a package which graphically represents all the event trees present in the QRA, with all the current relevant data on each branch. This package will also calculate all the required outcome parameters, by multiplying through the event tree. However, when the user moves the cursor to a specific data point, the origin of that data, plus any other parameters one would like to illustrate (e.g. uncertainty), could be communicated on the screen in its own window. The source of the data's origin could be held in a source file, which is only accessible by one person, who could be named the 'data-protector'. Therefore, whenever studies had been performed or greater

sample sizes became available due to spate of accidents, which had revised the data, the data-protector could access the source file and update it with the relevant information as to its exact origin.

- This proposal for future research is not connected to the work produced in this thesis, as the risks examined in this study are technical risks and as such, are expressed in one unit (or attribute), whether it be number of fatalities, probability of the event occurring etc. There are future possibilities for developing a multi-attribute decision theory (Keeney and Raiffa, 1993), whereby more than one attribute (reputation, cost, no. of fatalities etc.) can be combined and taken into account in a risky decision. This approach is essentially an advance form of cost-benefit analysis. The main difference is that the value structure (non-linear effect of outcomes on the organisation), risk attitudes (risk averse, neutral etc.) and value trade-offs (value of life, value of publicity etc.) are embodied in multi-attribute decision theory. This technique is extremely mathematical in nature. Development could ensue on multi-attribute utility functions, whereby a single numerical value (multi-attribute utility) could be expressed for a combination of outcomes. These could then be compared against other decision options and the value with the highest utility is selected.

- Due to the relevance of the questionnaire used in this thesis, it would be extremely interesting to ascertain the results from the two industries in 5 or 10 years from now, to see just how much risk management has changed. The reason for this proposal is that risk management, at the moment, is going through a critical time and views and processes alter in as little time as five or so years, so the same questionnaire would be useful and direct comparisons could be made. Of course, amendments would be needed to some of the questions to update them. There are, nevertheless, potential problems with this proposal, as ideally the respondents would need to be the same and working for the same company etc. This scenario, however, is ideal and realistically is not possible, as the respondents may have moved departments or to another company (maybe not

even related to the construction or oil and gas), could have retired etc. However, sending to the same largest companies within the two industries would still be very interesting. Then, having analysed the results, improvements could be proposed to the future's risk analysis techniques, or some other aspect of the risk management process.

- One future niche in the oil and gas industry market would be to produce enhanced user friendly databases for accident and incidents to help improve the failure data, as well as developing better methods of maintaining and updating this data. One of the problems with the oil industry is the lack of available failure data. One possibility would be to incorporate some kind of system that is connected to all the offshore platforms in the North Sea, or maybe even the World, which collates all the accidents, incidents, near misses etc. and immediately inputs them into a database onshore, e.g. as soon as a gas leak occurs the information (i.e. size of hole, release rate etc.) is passed by computer to the onshore database where it is updated. The data would gather far quicker and would become more reliable. Some of the statistical books used at present are over 10 years old and with new technology, equipment, procedures, etc. the probabilities and frequencies are out of date and unreliable and, therefore, not relevant.

- Accidents and incidents can be caused by two sources. These two are mechanically or through human intervention. Many of the offshore operators feel that the latter is more to blame. Therefore, an investigation into the exact effects of the human element in risk management could prove to be profitable. At present within AHL (and most probably every other oil company), the data used for the QRA, and hence the SC's, have simply added 30% to the process equipment failure to account for human error. This value may be totally different and only an in-depth study of human behaviour related to the offshore sector would confirm this, thus this idea could be the subject of a future Doctoral Thesis.

- As mentioned in RMRI (1996a), a recent literature review (AEA Technology, 1996) identified what data is available on ignition probabilities relevant to offshore installation fire and explosion hazards. The review shows that data and methods are sparse, and that there have been few attempts to collect data on leaks and ignitions in a structured and consistent manner. In particular, the review highlights that the model used in the QRA for gas releases can severely under predict ignition probabilities for minor leaks. There is scope, therefore, to improve ignition data, by experimenting with different kinds of oil and gas and subjecting them to different ignition sources, in an investigative nature. It would be an idea, as oil composition varies from one field to the next, to extract some oil from AH001 and use this oil, in order to find the ignition probabilities specifically for this oil field alone. This exercise could be done for every oil field and installation specific probabilities could result. Another variable could be the conditions the situations are under, i.e. in water, windy, confined spaces, different types of oil etc. To date a study has calculated ignition probabilities from a collection of hydrocarbon releases and their consequent probability of ignition and by basing a model on a correlation with mass release rates. By doing what the author has suggested, above, will increase peoples knowledge and confidence in ignition data. This could also be done for the gas for each installation.