

Master Thesis

## **Nuclear Engineering**

# **Development of a probabilistic model to estimate the risk of a toxic release due to a train accident in the proximity of a nuclear power plant**

**PRACTICE MEMORIES**

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# Index

<b>INDEX</b>	<b>1</b>
<b>1. PRACTICE DATA</b>	<b>2</b>
1.1. Student data .....	2
1.2. Workplace .....	2
1.3. Timetable.....	2
<b>2. INTRODUCTION</b>	<b>4</b>
2.1. Academic situation .....	4
2.2. Acquisition process .....	4
2.3. Objectives.....	4
<b>3. WORK ENVIRONMENT</b>	<b>5</b>
3.1. Work environment.....	5
3.2. Responsibilities .....	5
<b>4. TECHNICAL ASPECTS</b>	<b>6</b>
4.1. Performed tasks .....	6
4.2. Development problems .....	6
4.3. Challenges .....	7
<b>5. EXPERIENCE</b>	<b>8</b>
5.1. Learned skills .....	8
5.2. Overall experience .....	8
<b>6. CONCLUSIONS</b>	<b>9</b>

# 1. Practice data

## 1.1. Student data

Name and surnames:

ID: 78939603S

Address: Comandante Benítez 20, 4<sup>0</sup>-3<sup>a</sup>, 08028 Barcelona

Phone: +34 680 155 076

Email:

## 1.2. Workplace

Advanced Nuclear Technologies Research Group (ANT)

Physics and Nuclear Engineering Department

Escola Tècnica Superior d'Enginyeria Industrial de Barcelona

Av. Diagonal 647, 08028 Barcelona

Phone: 93-401-66-15

Practice tutor:

Email:

## 1.3. Timetable

Schedule per day: 9:00-13:00 and 14:00-17:00

Schedule per week: from Monday to Friday

Starting date: October 2nd, 2017

Ending date: March 16th, 2018

Total number of hours: 450

## **2. Introduction**

### **2.1. Academic situation**

Practice period was designed to students that have studied the Master degree in Nuclear Engineering and need to do their practice lessons to fill the master's ECTS credits linked to the compulsory practices.

### **2.2. Acquisition process**

As the university is a public institution, practices were exposed on a public contest of offer of employment practices.

Among other applications, mine was finally selected as was the one that fit better the conditions required to fulfil the job.

### **2.3. Objectives**

The objective of practice period was basically accomplishing the ECTS credits that needed to fill to be able to finish master studies.

## **3. Work Environment**

### **3.1. Work environment**

Practice job was performed within the Advanced Nuclear Technologies Research Group (ANT) of the Physics and Nuclear Engineering department of the university.

Consulting project has mainly been performed in an office, with a desk and an individual laptop. Office work took place being alone or working alongside with the PhD student performing different tasks. Cordial relation between them and with the professor/tutor avoid any threaten situation.

### **3.2. Responsibilities**

Perform a probabilistic safety assessment (PSA) analysis was the duty of the project, specifically analysing a derailment of a freight train and the generation of the toxic cloud that would lead to unavailable the control room of a nuclear power plant.

As train derailment was new engineering aspects that no-one on the department new about it, I was responsible becoming somehow an expertise on such field, Train and railway aspects (design, maintenance, safety systems ...) needed to be understood, so extended bibliography lecture was performed.

Besides, I was in part responsible when asking for data to the Spanish rail network organizations; data that needed to be obtained to fulfil the total PSA of the model we were looking for. Unfortunately, they didn't give us permission to access the database.

## 4. Technical aspects

### 4.1. Performed tasks

These are the activities performed:

- Bibliography and references lecture
- Data collection
- Software using learning
- Probabilistic Safety Assessment methodology performance
- Project writing

### 4.2. Development problems

First problem was to learn how train sector works, in other words, learn basic aspects on freight train circulation, accident, transported hazardous material conditions and other aspects related to this engineering field (we came from nuclear field).

Afterwards, I entered on PSA analysis, its intrinsic aspects and how it is performed. Once PSA analysis was understood and how derailment occurs was known, the qualitative part of the PSA was performed.

Reading some references, we realize that quantitative part of the model was affordable, as references make clear that data we were looking for was available. However, unfortunately, when we contacted the Spanish railway regulators, Adif and Renfe, they deny us the access to the database. Then, quantitative part of the model was impossible to perform.

### 4.3. Challenges

These are the challenges we face on the development of the project:

- Use of a third language, English, specifically related to technical vocabulary
- Understanding aspects of rail field: rail traffic, design and maintenance aspects, safety systems and their duties, regulations and procedures against accidents.
- Implementation of a PSA to a freight train derailment
- Understanding the initial conditions that lead to a derailment, why are those the initial conditions and some other aspects
- Understanding a toxic material release after an accident
- Group task performance
- How communication is made between the department and the nuclear facility that commanded us to perform the job
- How communication is made when requesting data, that may be not accessible to the public due to security reasons, to a public organization



## 5. Experience

### 5.1. Learned skills

These is the list of the skills I learn through the project performance:

- Improvement of my English knowledge linked to technical vocabulary
- Probabilistic Safety Assessment intrinsic aspects obtained
- Introduced to rail engineering field
- Understanding threatens nuclear facilities are facing
- Group job skills trained
- Communication skills trained

### 5.2. Overall experience

Tasks performed were in accordance, somehow, with the subjects I learned on the master, specially related to probabilistic safety assessment as well as some other aspects were linked to the deterministic safety assessment.

Then, project development fulfilled my professional expectations.

## 6. Conclusions

From my point of view, these practices have been very interesting and useful from the professional point of view.

I have been able to apply my theoretical knowledge obtained by the master's subjects and I also introduce myself in an unknown engineering field (train sector), learning new concepts.

I have known a sector of great potential, especially due to Fukushima accident, and its uniqueness has allowed me to learn new theoretical knowledge and a lot of practice.

I have to thank the PhD student and the tutor supervisor for the trust and responsibility that they have given and the fact that they have always been willing to answer all my doubts.

In addition to the theoretical and practical knowledge learned during my stay in the department, I value very positively the fact that I have known how research is performed within a college in collaboration with a private company.

Above all, I believe that trust in what you do and do well is the main stimulus not only in the professional aspects, but also as norm of action in everyday life.