ALARA AND PLANNING OF INTERVENTIONS

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INTRODUCTION

The implementation of ALARA programs implies integration of radiation protection criterion at all stages of outage management. Within the framework of its ALARA policy, Electricité de France (EDF) has given an incentive to all of its nuclear power plants to develop "good practices" in this domain, and to exchange their experience by the way of a national feed back file.[1] Among the developments in the field of outage organization, some plants have focused on the planning stage of activities because of its influence on the radiological conditions of interventions and on the good succession of tasks within the radiological controlled areas. This paper presents the experience of Chinon nuclear power plant.

At Chinon, we are pursuing this goal through careful outage planning. We want the ALARA program during outages to be part of the overall maintenance task planning. This planning includes the provision of the availability of every safety-related component, and of the variations of water levels in the reactor and steam generators to take advantage of the shield created by the water. We have developed a computerized data base with the exact position of all the components in the reactor building in order to avoid unnecessary interactions between different tasks performed in the same room. A common language between Operation and Maintenance had been established over the past years, using "Milestones and Corridors".

A real time dose rate counting system enables the Radiation Protection (RP) Department to do an accurate and efficient follow up during the outage for all the "ALARA" maintenance tasks.

Planning Jobs on the Safety Related Components Taking into Account the Cold-shutdown Technical Specifications: Developing a Common Language Between All the People.

Detailed Cold Shutdown Technical Specifications have been developed and are to be strictly followed during an outage. They address the availability of on-site and off-site supply of power, emergency core cooling system (ECCS), reactor water level, reactor heat removal, reactor spray system, etc.

Before an outage, and as early as possible, typically six months before a given outage, each maintenance department gives its own maintenance program to the planning department. As early as possible, typically four months before the start of a given outage, we take these programs into account with the Technical Specifications and we establish:

L. STRICKER, ALARA Policy at Electricité de France, Third International Workshop on the Implementation of ALARA at Nuclear Power Plants, BNL, Long Island, May 8-11, 1994.

- The so-called "milestones" are key moments in the outage, such as the first opening of the reactor primary circuit, the end of defuelling, and the start of Mid Loop Operation, etc. These milestones are labelled using letters, A, B, ... Z. Generally speaking, each major alteration in reactor water level corresponds to one milestone, such the isolation of a specific ECCS safety line or electrical power source.

- The so called "corridors" between two milestones. To every maintenance task, a corridor is given and this task can only be performed in this given corridor. For example, corridor JK, FN..., so that every foreman will know when a specific task should be performed.

The very important aspect of this is that everybody, from the control room operator to the valve mechanic will use the same language, during the outage long, and they will understand each other far better.

Figure 1 is an example of such planning.

Establishing the "Shuttle Notes" So Every Technician and Job Specialist Can Explain His Normal and Specific Logistic Needs.

Working "On Line":

Over the last two years we have been developing an "on line activity" concept, which means that maintenance technicians are made fully accountable for a specific maintenance task. This includes performing a safety risk analysis, establishing the maintenance procedure and various paperwork, contracting with the help of the bargaining division, meeting with the other workers needed to carry on the activity, then monitoring performance on the field, and recording the experience for future outages. Furthermore, we request each of them to prepare and follow the job, not only considering safety, quality assurance, cost effectiveness, and also addressing the radiation protection and industrial safety side of the activity. These people have all the needed background and tools on hand to do it! Part of this includes preparing the "shuttle notes," which are a communication tool.

These shuttle notes list all the logistic side of a maintenance activity as well as its location:

- necessary scaffolding
- radiation shields to be put in place
- needs for in service inspection techniques after welding
- the actual location where the maintenance task will take place
- all of this taking into account the recorded know-how from previous outages

All of these tasks are written using diagrams representing the Reactor Building floors with the exact location of the job. To help technicians in establishing these, they have been given Reactor Building maps, floor by floor, where all the pieces of equipment are precisely located. Each of the maintenance specialists, such as valve mechanics, primary pump mechanics, I&C technicians, have a map of the Reactor Building floor indicating where they are going to work, together with all their needs.

Figure 2 is an example of such a diagram.

Figure 1

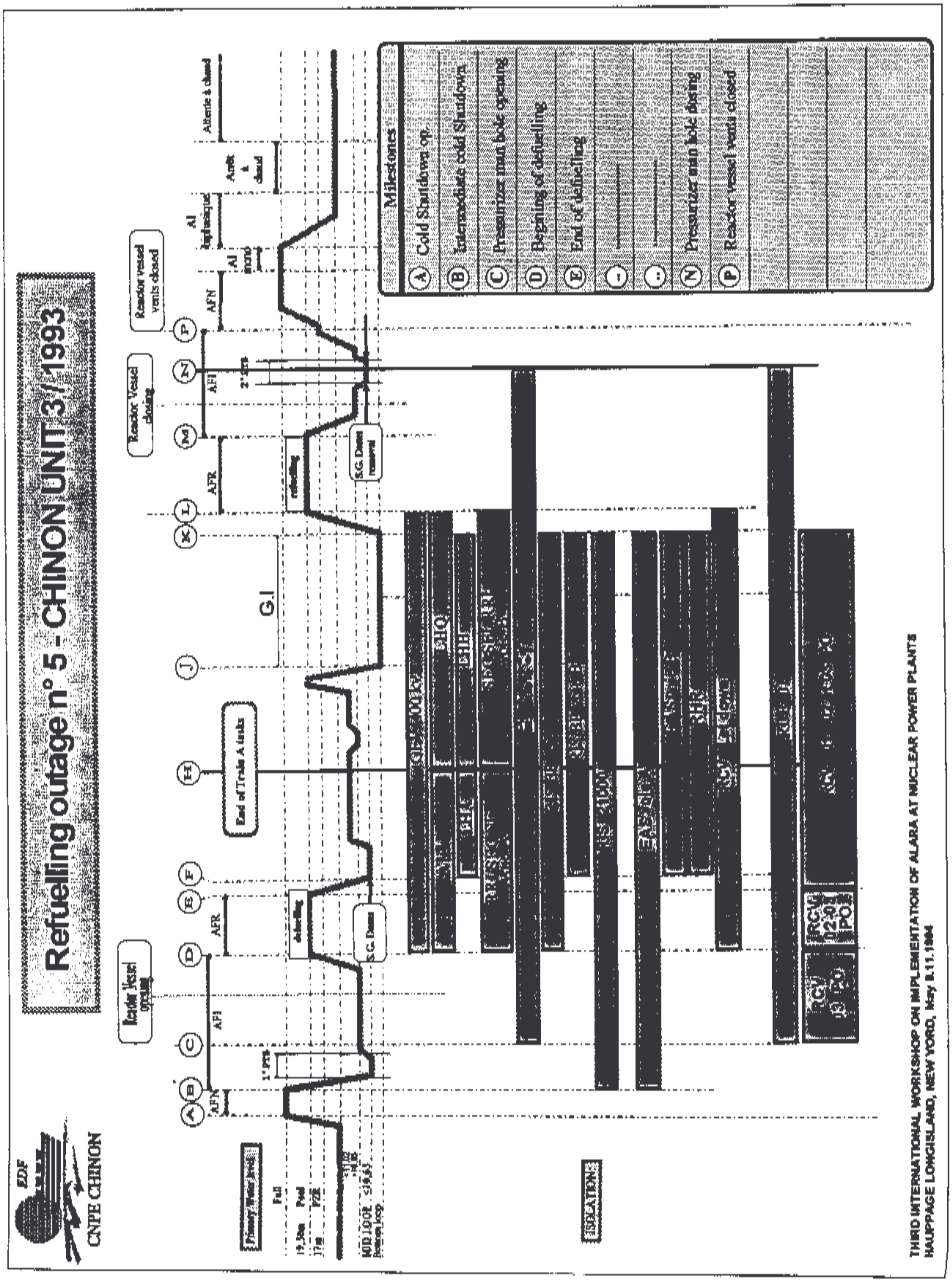
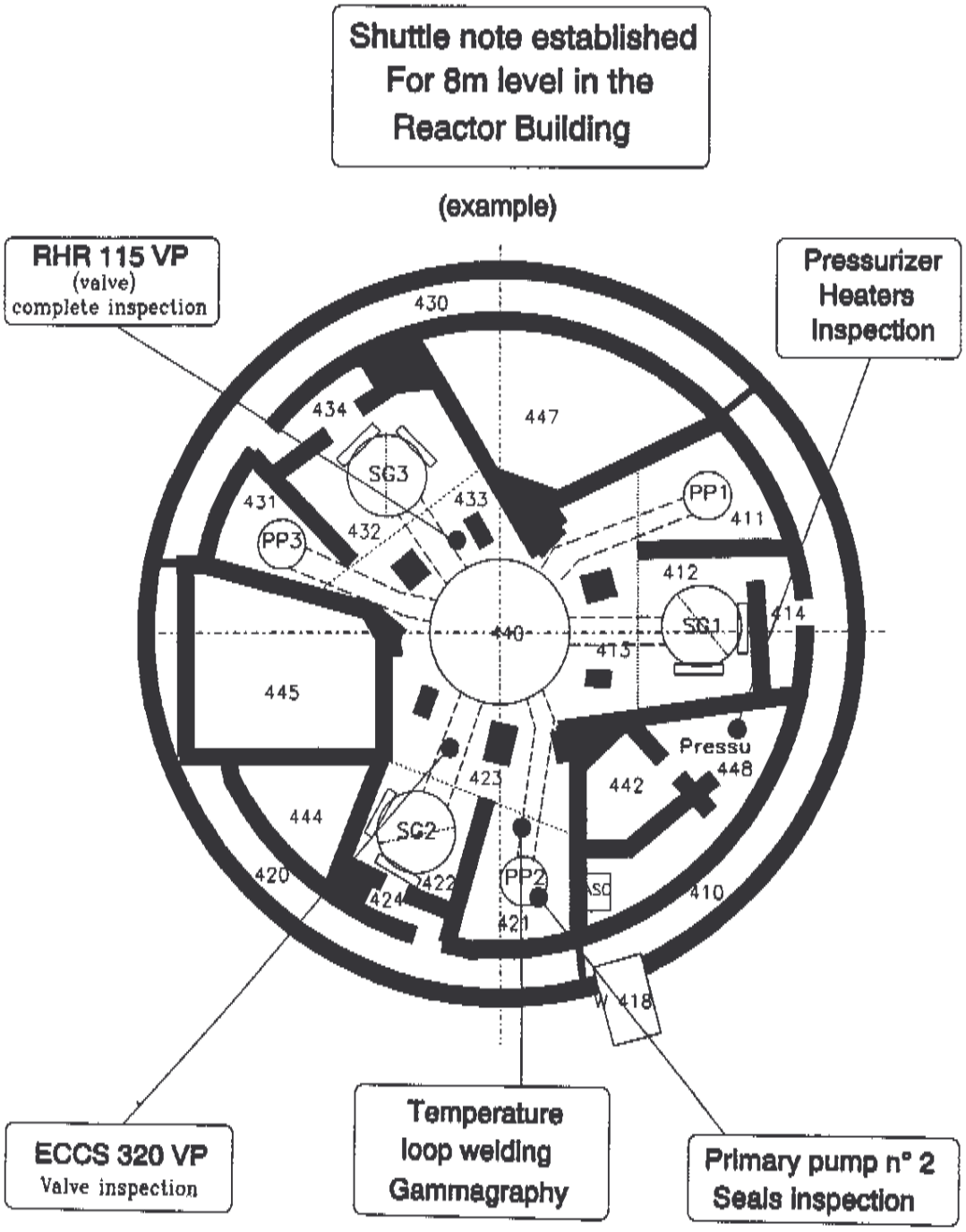

Refuelling outage n° 5 - CHINON UNIT 3 / 1993
CNPE CHINON
EDF
Milestones
A Cold Shutdown op.
B Intermediate cold Shutdown
C Pressurizer man hole opening
D Begining of defuelling
E End of defuelling
N Pressurizer man hole closing
P Reactor vessel vents closed
Reactor Vessel opening
End of Train A tasks
Reactor Vessel closing
Reactor vessel vents closed
S.G. Dam
S.G. Dam removed
G.I
AFR
API
APN
ISOLATIONS
Primary Water level
THIRD INTERNATIONAL WORKSHOP ON IMPLEMENTATION OF ALARA AT NUCLEAR POWER PLANTS
HAUPPAGE LONGISLAND, NEW YORK, May 8.11.1994

Figure 2


Shuttle note established
For 8m level in the
Reactor Building
(example)
RHR 115 VP
(valve)
complete inspection
Pressurizer
Heaters
Inspection
ECCS 320 VP
Valve inspection
Temperature
loop welding
Gammagraphy
Primary pump n° 2
Seals inspection
430
434
447
SG3
431
433
PP1
411
PP3
432
412
414
SG1
440
415
445
Pressu
448
423
442
444
SG2
420
422
PP2
424
421
410
418

The Planning Department Collects All These Shuttle Notes in Order to Establish the Final Planning for Every Maintenance Department.

This is a very important step, as all the work that cannot be performed at the same time and at the same place will be obvious to the planning technicians. They now have very valuable documents to work on to plan all the jobs in the reactor building, and they are ready for the next step, which is to organize meetings with all the support people, i.e., radiation protection, scaffolding, shielding technicians. During these meetings, they establish:

- the kind of shielding to be used, when to put it in place, how to set it for the maximum advantage, and to minimize the dose rates.
- which jobs are chosen to conduct a more specific ALARA process, based on experience from previous outage at Chinon Nuclear Power Plant (NPP) or from other EDF plants.
- the detailed planning using the safety "corridors."

RESULTS

This common language used among all the employees at the plant has allowed us to achieve promising results, through better assessment of when to perform each task, and not only the main ones.

For example :

1. In March 1994, deinsulation of all the primary circuit prior to a 10-year hydro test costed us only 8,6 Man mSv instead of an usual 300 Man mSv because of carefully choosing the time to perform it.
2. Between 1992 and 1993, the dose rate for a similar annual refuelling outage was reduced by 30% (from 2.3 Man Sv to 1.6 Man Sv).

   We hope to get a 50% reduction by pursuing the same approach to all the tasks.

Brief Introduction to the Chinon Power Station

The Chinon Nuclear Power plant is a 4 Unit 900MWe Pressurized Water Reactor (PWR) power station owned and operated by EDF, the utility which operates the 56 nuclear units in France. The first Chinon PWR unit was put on line in 1983, the last one in 1988.

An overall availability factor of 81% was achieved in 1993 for the four units. A typical cycle between refuelling outages lasts 10 to 12 months. The outage lasting 45 days (average value for 1993, down from 52 days in 1992) with extensive controls performed on safety related equipment. The overall performance is to be considered as average as compared to other French PWRs.

In 1993, the total radiation exposure reached about 9 ManSv (900 Man Rem) with no so "clean" units: we experienced some control rods clad failures in 1990 that polluted the unit 1 primary circuit with "Silver 110,"

and some valve stellite seats induced "hot spots" on Unit 2 in 1993. Our current goal is to achieve a utility wide goal of 1.6 Man Sv per unit per year by 1995. Some newer plants (1300 MWe PWRs) have achieved promising results in that respect, such as a Golfech Unit with a 0.6 Man Sv (60 Man Rem) refuelling outage.

Author Biography

Alain Rocaboy is currently Plant Manager for two PWR 900 MWe Units at Chinon Power Station in France. Before joining Chinon in 1991, he has been working at the Blayais Nuclear Power Plant for 13 years where he was successively in charge of operations, Deputy Plant Manager and Safety Superintendent. He started his career within EdF in 1968, at an experimental Heavy Water-Gas Cooled Reactor in Brittany. He has a Professional Engineering degree from the French National School of Electronic Engineers of Brest.

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