



# ATUCHA I:

# UNFORESEEN PERSONEL EXPOSURE

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# Background Information



**Country: ARGENTINA**

**Plant Name: ATUCHA I**

**Reactor Type: PHWR (357 MWe)**

**Start of Operation: 1974**

**Date Of Incident : September 1st 2005**

**INES RATE: 2**

**IRS NUMBER: 7833**



# Presentation Layout



**SUMMARY**

**EVENT DESCRIPTION**

**SAFETY ASSESSMENT / CAUSES OF THE  
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**CORRECTIVE ACTIONS TAKEN AND  
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# SUMMARY



During the calibration of the refuelling machine, an unexpected spill of heavy water took place and as a result, plant personnel were exposed to tritium.

Trying to control the situation, one of the workers received an unplanned dose due to internal absorption of tritium of 41,85 mSv

This dose exceeded the annual as well as the dose limits authorized by regulatory standards over the last 5 years



# SUMMARY



**Three root causes and four contributing causes were identified.**

**The methodology applied to conduct the evaluation has connected the causal factors for the different identified causes, with the levels of responsibility of the organization.**

**It was observed in the mentioned method of evaluation that diverse causal factors exceeded the barriers that must have acted in each one of the previous levels**



# SUMMARY



**The Utility carried out changes in the maximum levels of management of Atucha-I.**

**The justification of this decision was based on “a progressive deviation of the practices that must be strictly respected to maintain the quality required to operate and perform maintenance tasks into a nuclear power plant”.**

**The performed changes were consistent with the following areas: Management, Operation, Radiation protection, Maintenance and Production.**



# Event Description



## Stage 1: Preparation tasks

**On August 31st the RM was set in operation and soon after, some abnormalities appeared determining the need to make several calibrations in it. To achieve this, Operation Department released a series of Warning Failure (WF's)**



# Event Description



**These maintenance jobs required to put the RM out of service, by setting it to "test".**

**According to analyzed information, deficiencies in communicate responsibilities for tasks between 2 operation shifts were detected.**

**These led to an inadequate preparation of the RM for the tasks to be performed during the next day**



# Event Description



## **Stage 2: RM tasks during the event day**

**During the briefing at 07:30 in the morning of 01/09/05, maintenance tasks to be done during the day were discussed**

**Several tasks related with electrical and instrumentation and control maintenance were prepared to be done at the RM, like Calibration of drum / flask position (task 1), simultaneously with the "Review open end of stroke of valve PL01S022" (task 2)**



# Event Description



After initiated the authorized tasks, the Refueling System Operator (RSO) considered **to verify the calibration of the air position indicator of the lock of the drum of the RM (component identified as PL01M003).**

This task was not included into the authorized plan, therefore did not have the corresponding WF and Work Authorization (WA) signed, nevertheless the RSO decided (together with Instrumentation and Control Supervisor) to do it.



# Event Description



Therefore, during the morning several tasks of electrical maintenance and instrumentation and control were made in the RM, like Calibration of drum / flask position (task 1), simultaneously with the "Review open end of stroke of valve PL01S022" (task 2)

Task 1 execution began to be achieved by personnel from electrical and instrumentation and control. Mechanical maintenance working at the place, requested for assistance from Mechanical Maintenance Supervisor (MMS) and 2 more technicians who were working in a different zone of Controlled Area.



# Event Description



To carry out task 1, personnel opened a hood (hood corresponding to the PL01M003) and placed a hose with extension to connect the RM to a system to produce depression in the RM (TY system).

After finishing task 2, Radiation Protection Officer (RPO) (in Control Room) opened the valve, generating pressurization of RM resulting in gas coming out and heavy water blowing through PL01M003. As a consequence several people were contaminated.

An immediate personnel evacuation took place, without finishing task 1 including the hood that was out of its place



# Event Description



*During the evacuation the corresponding acoustic alarm was not sound. This alarm is critical to prevent the potential access of non-authorized personnel into the spill area.*



# Event Description



## Stage 3: Tasks of Cleaning, Drying and Spill Control

Due to tritium presence in RM area, maintenance personnel left the zone.

MMS decided to enter the zone to fit the hood, without previous planning. RPO dressed the MMS with a protection suit, with independent breathing equipment.

MMS came into the area alone and immediately heard the alarm "air tube empty". Then, he decided to take off the independent breathing equipment and, without mask, he fitted the hood. After that, he left the reactor building.



# Event Description



## Stage 4: Recovery Actions

At this time, RPO suspected that the heavy water came from the system TA. Consequently he asked operations personnel to close the valve identified as TW10S01. That meant that the leak was coming through the hose unions.

Heavy water spill finally was controlled when mechanical maintenance personnel went into the RM area to close valve PL01S090 and repaired the leaking hose



# Event Description



**Evaluations and measurements of received doses determined that only one worker had received a significant dose.**

**This person (MMS), received an effective dose by internal tritium intake of 41.8 mSv. The mentioned worker, who had at July 2005 an accumulated 12.63 mSv annual dose and 92.13 mSv in five years, exceeded the annual and five years limits authorized by Regulations**



# Safety Assessment

## Root Causes of the Event



- Failure in programming, coordination and execution of maintenance and calibration tasks: Lack of procedures, WF without properly processing WO and identifying orders to operate (OPO' s), lack of work plans and instructions
- Failure in preparation of a set of instructions to act in a coordinated way in situations which involve heavy water spills without having identified the situation of the related systems and the possible causes that originated it



# Safety Assessment

## Root Causes of the Event



- Failure in barriers represented by calibration and maintenance procedures and/or its properly use.

Q.A allowed to perform tests and/or calibration without the required authorization represented by procedures



# **Safety Assessment**

## **Contributing Causes of the Event**



**Failure in the implementation of adequate measures to guarantee the fulfillment of Regulatory Requirement N 12 (related with dose constraints)**

**Failure in maintenance and renewal of obsolete radiation protection equipment**



# Safety Assessment

## Contributing Causes of the Event



**Deficiencies in transmission of pending tasks between operation shifts, deficiencies in definition of priorities and preparation of instructions about the condition of the RM before the work**

**Weaknesses in the training of the correct use of the equipment and techniques of radiation protection, and in the selection and use of the suitable protection clothes**



# LESSONS LEARNED AND CORRECTIVE ACTIONS



- 1- Dissemination of the event to all the CNA-I sectors, enforcing the supervision of application of procedures PI 01, PI 16 and PS 16.**
- 2- To prepare retraining of operators of RM, shift heads and assistants of shift heads in "procedure to operate number 5" (POP05)**
- 3- To prepare retraining for radiation protection personnel in accomplishment of plant documentation requirements, specially in corrective actions**
- 4- To prepare retraining for maintenance personnel in application of procedures PI 01 (Order to operate), PI 16 (Management of tasks in CNA-I) and PS 16.**



# LESSONS LEARNED AND CORRECTIVE ACTIONS



**5- To prepare retraining for Q.A personnel in application of procedures PI 01 (Order to operate), PI 16 (Management of tasks in CNA-I) and PS 16 (Work Authorization).**

**6- Manager of CNA-I would define the policy to follow for allocation of Administrative Resources**

**7- To prepare a retraining program for supervisors and technicians in the use of radiation protection equipments**



# LESSONS LEARNED AND CORRECTIVE ACTIONS



**8- Manager of plant would introduce this event in the courses of safety.**

**9- Operation Section would carry out a pilot experience in self-evaluation**

**10- To define actions to be implemented with personnel that have dose limitations. Establish limits of 90 mSv in 5 years**

**11- To analyze the possible modification of pipe TY 11 (build an extension) toward the RM maintenance room**



# CORRECTIVE ACTIONS INCLUDING LATER



**CNA-I Management introduced other changes in personnel and procedures of Production Area, incorporating employees with experience in the operational areas of the primary and secondary systems.**

**CNA-I updated PP-09 "Management of Tasks in CNA-I", transferring procedure PI 16 from Engineering to Production, with the purpose of guarantee the adequate closing of daily / weekly programming before the execution of tasks**

**Afterward, some changes took place at the level of management staff of the facility**



# Event Precursors / Recurrences



- a) 16-03-01. During Programmed Outage an agent received a dose superior to the annual limit allowed (1)
- b) Internal event N° 12/04. The direct cause of this event was violation of internal procedures, because the tasks were executed without WO. The identified root causes were: Unsafe work practices, Unsuitable habits developed by the pressure/culture of the group and "Taking allowed short cuts/tolerated". (2)



# Event Precursors / Recurrences



- c) Internal event N° 04/05: Two of the event causes were identified as “lack of coordination to do the work (without WO)” and inadequate preliminary evaluation of exposure rate” (3)
- d) Internal event N° 05/05: The W.O was emitted but dose received by personnel exceeded the allowed for the job. It was caused by changes made by supervision who increased the amount of tasks previously authorized. Root causes: “Inadequate preliminary evaluation of exposure rate” and “Inadequate supervision of work time” (4)



# References



- (1) Internal event, external irradiation. Level 2. Date: 16-03-01
- (2) Tritium Intake, Internal event. Level 2. Date: 04-05-04
- (3) Radioactive Contamination. Level 3. Date: 21-02-05
- (4) Dose exceed the stipulated in the work order. Level 2. Date: 26-02-05