Spain Expert Report 30/10/00

Report on the repair of the British submarine nuclear Tireless in Gibraltar
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1, Antecedents
Nuclear submarine " HMS Tireless " of the United Kingdom the past arrived month from May at the port of Gibraltar with a failure derived of a flight from the primary circuit of refrigeration of the reactor. The British Navy analyzed the possible alternatives to repair the submarine and concluded that the most suitable era to make the operations in the Port of Gibraltar. The Government of the United Kingdom communicated to the Spanish Government his intention to repair the submarine in the Port of Gibraltar, and this one decided that the competent national organisms processed a specific plan of performance to protect to the population of the region of the Field of Gibraltar of the associated radiological risks to the stay of the submarine in the Port of Gibraltar. This plan was prepared by the DGPC, considering the technical bases established by the Nuclear Security Council.
The repair activities began in the middle of the month of September and they have come developing with normality. In the last weeks, the results of the works conducted in the zone of the crack have shown that the origin of the same one different from is initially postulated. This new situation causes that it is required to reframe the method and the calendar of repair, without in no case the state of the reactor is modified. With object to have sufficient information to value the new situation, the CSN maintained, day 26 of October, a meeting of work with representatives of the Regulating Panel of the British Navy, which also they attended representatives of diverse departments of the Spanish Government. In this document an analysis of the new situation raised in the repair of the submarine appears.

2, Sources of information.
The information that it arranges the CSN to analyze the repair of the failure of the Tireless submarine, and to consider the existing risks to the Spanish population of the cities of the surroundings as a result of the presence of the submarine and the operations associated to the repair process, has been provided by the British, competent regulating organism in military subjects, " Nuclear Regulatory Panel, (NRP) ".
The information is provided by the president of the NRP, in the course of meetings which they attend in addition representing to the British embassy. By Spanish part they attend technicians of the CSN and representatives of the ministries of outer subjects, defense, and interior and cabinet of crisis of the presidency ministry. Two encounter have been celebrated in which the information has been transmitted essentially of verbal form, with presentation of photographies and diagrams sufficient to understand the reach of the failure. Despite in the last meeting, held day 26 of October, the Spanish representation asked for a greater degree of formalization of the meetings, establishing the agenda and the accomplishment of the act. Also one remembered that, besides to have the technical information, the CSN must have

access to the documentation of security emitted by the British regulating organism to authorize the different phases from the repair process.

3, Characteristics of the failure.

The failure consists of a crack located in the zone of union of two pipes that affects to the weld between both and also jeopardizes to the material base of one of them. The crack is of pasante nature and caused a permanent dripping of liquid when the reactor was in operation. The total volume of the flight was considered in about 200 ls. Both pipes belong to the circuit of refrigeration. Since the water that circulates through this circuit is contaminated, the flight is of radioactive nature. The analyzed works to clarify the causes of the failure have allowed to establish the hypothesis that the crack has taken place as a result of a process of thermal fatigue, due to the communication of two factors: a defect of design in the characteristics of mechanization and the temperatures stress that take place in that zone during the normal operation of the reactor. The British Navy made an inspection in all the nuclear submarines of similar characteristics, verifying the existence of the same type of cracks in other units in service. These cracks that had not gotten to produce flights, determined the instruction of retirement on watch on the part of the British authorities. The existence of the same kind of problem in other units confirms the in question hypothesis of a generic problem of this class of reactors that is located and restricted to this concrete point of the circuit.

4, Program of repair.

The fact that the crack affects to the material base of one of the nonsingle pipes and the zone of weld does necessary to change the method of repair initially designed. Of essence the new method consists of cutting the pipe, adjusting by means of mechanized the zone of the cracked pipe and to weld a piece, special that allows the connection of the secondary pipe. This method must be approved by the NRP in all its ends; it is to say must cualificar the maquina to mechanize the pipe, the piece of connection and the later method of weld.

4,1, Uncertainties

The connection piece is of commercial manufacture and before his use it is due to verify that it fulfills the requirements necessary of nuclear quality to be able to be used in the primary circuit of refrigeration of the reactor. The qualification of this piece constitutes the only element of uncertainty associated to this process. From the technical point of view the repair does not present/display mayores technical difficulties, although the exigency of qualification of the method and the disposition of the tools introduce a delay of three months on the initial estimation

4,2, Alternatives

In case that the connection piece does not surpass the qualification process, the method could not be approved and would have to consider a different solution, cradle in an alternative layout of the secondary pipe, with the consequent alteration in the repair calendar. In these conditions it is not possible to establish a date of completion.

5, Calendar of repair.

In agreement with the estimations made by the NRP, the program of provisional repair it will be prepared at the end of November. The qualification of the connection socket, the maquina of cut and the method of weld at the end of the month of January. The duration of the repair properly said would be made in a period of three weeks. As

of this moment the assembly of the different equipment and retired elements would begin to make the repair. The operation tests would be made later. Consequently, at the moment, in the positive scene of which the qualification process is surpassed, esteem that the complete process would conclude at the end of March.

6, Verifications of the effectiveness of the repair.
The correct operation of the primary circuit after the repair will be verified by means of:
• the accomplishment of non-destructive testings in the welds of union of the repaired zone, by means of techniques of x-ray and ultrasounds.
• the accomplishment of one proves hydrostatics that allows to verify the integrity of the primary circuit by means of an increase of the pressure in he himself and the verification of ausenciade flights. In order to make this test the nuclear reactor will not be put into operation reason why a hypothetical failure would not jeopardize the nuclear security

7, Risks
At the present time the nuclear reactor of the submarine remains unemployed in safe conditions, with residual heat generation a very small and in diminution, reason why its refrigeration is guaranteed with the natural dissipation to the atmosphere, without requiring no system of forced refrigeration. The analysis of the activities that will be developed during the repair process, allows to affirm that the reactor will remain in identical conditions of safe shutdown to the present ones.

8, Final valuation.
8,1, In the present context the security of the reactor is guaranteed, in all the phases of the repair process. Consequently, risk for the Spanish population of the localities located in the region of the Field of Gibraltar does not exist. The possibility that spills of radioactive liquids to the sea are made during the repair process is practically null. Despite the CSN it will maintain the measures of monitoring of the medio.ambiente established in the Plan of Performance before an incident potential during the stay of the submarine in Gibraltar. This plan will have to continue being applied without modification some from the point of view of the nuclear security and the radiological protection.

8,2, The method and the program of repair of the failure anticipated by the British authorities are technically acceptable. Uncertainties relative to the processes of qualification of the machine of cut and the piece of connection exist nevertheless whose results are not predictable at the present moment. Not it can, therefore, to totally discard the possibility of using another more complex method technically and than would extend the duration of the repair of considerable form.

8,3, The CSN maintains a relation formal and stable with the Nuclear Regulating Panel of the British Navy, by means of which it will have the technical information and the evaluations of teguridad necessary to evaluate the march of the activities of the repair program, whose detail has been asked for formally in the course of completes meeting.

8,4, In agreement with the established plan of coordination the CSN will maintain informed to the competent administrative authorities.