Alejandro ZURITA CENTELLES received an Industrial Engineering degree from the Barcelona Polytechnical University and a doctorate degree in Nuclear Technology Engineering from the Technical University of Hannover (W. Germany). For six years, he worked in the Institut für Kerntechnik of Hannover (IKH) in the development of thermohydraulic codes for simulation of PHWR and PWR research reactors, participating with this work in bilateral agreements of W. Germany with IPEN (Brazil) and CAB (Argentina). For more than three years, he worked for the Consejo de Seguridad Nuclear (CSN) in the Trillo I NPP licensing process. Since October, 1988, he has worked for Siemens, S. A.'s KWU department in technical support and service tasks related to Trillo I NPP. He is familiar with several fuel cycle installations in Argentina, Belgium, Brazil, France and Germany.

EMERGENCY RESPONSE CENTERS

A. ZURITA

INTRODUCTION

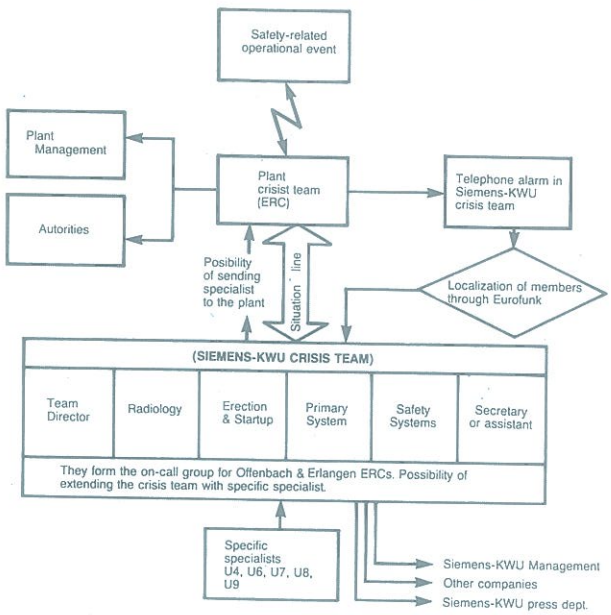
Evaluation of the experiences of the TMI-2 (USA) accident in 1979 led to a decision by Siemens-KWU to develop a strategy to suitably deal with emergency or accident conditions. This strategy materialized into the creation of two emergency response centers (ERC) in the Offenbach and Erlangen offices in West Germany. The Offenbach ERC is aimed at supporting plants with boiling water reactors, while the Erlangen ERC is aimed at pressurized water plants. Thus, since 17-3-80, the operators of nuclear power plants with Siemens-KWU design and technology have specialized and permanent support immediately available to them through these two CREs.

STRATEGIC CHARACTERISTICS IN THE EVENT OF EMERGENCY

The Siemens-KWU ERCs define their support of a plant in the event of a safety-related operational event as the prompt establishment of a crisis team made up of experienced specialists covering all technological aspects of the reactor and plant in question, taking measures required to mitigate the disturbance or its consequences and the possible initiation of preparations to send qualified specialists to the plant.

These functions or tasks involve the fulfillment of requirements, such as completely bringing together the crisis team in some thirty minutes after the alarm is given and at the latest within two hours, and also that this crisis team should cover all of Siemens-KWU's job specialties and have sufficient authority to make the most suitable and proper decisions. This implies the use of the Eurofunk acoustic and visual alert system to locate the crisis team members, as well as the proper strategic organization of each plant subject to possible analysis by this team.

Figure I shows the ERCs' lines of action on the basic of an emergency alarm alert transmitted by the plant.



F I *Action strategy in te event of emergency*

T I EXTENSION OF THE ERC CRISIS TEAMS

Subject	PWR	BWR
Plant dynamics	NLOOP-LOOP7	VERENA
Emergency cooling	RELAP 5	SAFE SAFER 02
Core heating	BETHY	CHASTE 07
Long-term zonal containment calculation	WAVCO	
Containment pressure & temperature calculations	COCO	TABU
Neutronic core design	MEDIUM	RS3D
Three-dimensional neutronic and thermohydraulic transients	PANBOX	
One-dimensional core transients	APCBOX	VERENA (COSBWR)
Determination of the injection rate in case of "Feed & Bleed" (TA & TW Systems)	STADRU	
Determination of heat to be removed through the cooling chain TH/TF/VE	YBENAKU	
Primary side calculation in startup and shutdown processes	PRIDUR	
Relief tank behavior calculation	HASY	
Fuel element activity inventory	KORIGEN	
Component activity inventory	ARESYS	
On-line calculation of the radiologic load to the environment	TSK	

As regards the organization of the crisis team proper, it should be noted that this team consists of the following posts:

- Team director.
- Specialist in safety system design.
- Specialist in reactor cooling system design (primary system).
- Specialist in radiology.
- Specialist in erection and startup.
- Secretary or assistant.

The six members of the crisis team make up an "on-call" group and with their decisions can intervene in the plant. This group immediately goes to the emergency response center in the event of an alarm and contacts the plant, giving the first directions to the plant's crisis team and, if necessary, taking other measures, such as sending specialists to the plant or enlarging the crisis team to include specific specialists for the plant in question that do not belong to the "on-call group" but that are included in the special telephone directories in the ERCs (see Figure I).
Within this extended crisis team, there are two specialists assigned to each of the following nine posts:

- Primary and physical reactor systems.
- Heavy components, materials, chemistry and containment.
- Operational core tracking.
- Radiological measurements and post-accident instrumentation.
- Reactor control (regulations and limitations).
- Process engineering of the auxiliary reactor systems, containment components and fuel element transportation.
- Turbine and system construction.
- Instrumentation and control and emergency electrical supply.
- Reactor protection.

The contributions of the extended crisis team as compared to the normal crisis team would on one hand be more specialized advice and on the other a calculation capacity through the use of different specific codes for certain safety analyses. Table I shows the diferent codes available for the different subjects to be analyzed. The use of codes in turn involves updating the input data for each code and plant, maintaining the corresponding programs and modifying these programs to obtain "best estimate" versions. The ultimate purpose of the initial or extended crisis team would depend on the type of emergency: for example, long term maintenance of subcriticality, or insuring core cooling and resulting maintenance of the heat sump, or assist-

ing the containment function or in decreasing the activity rates and their influence outside the plant.

ORGANIZATIONAL AND ADMINISTRATIVE FEATURES

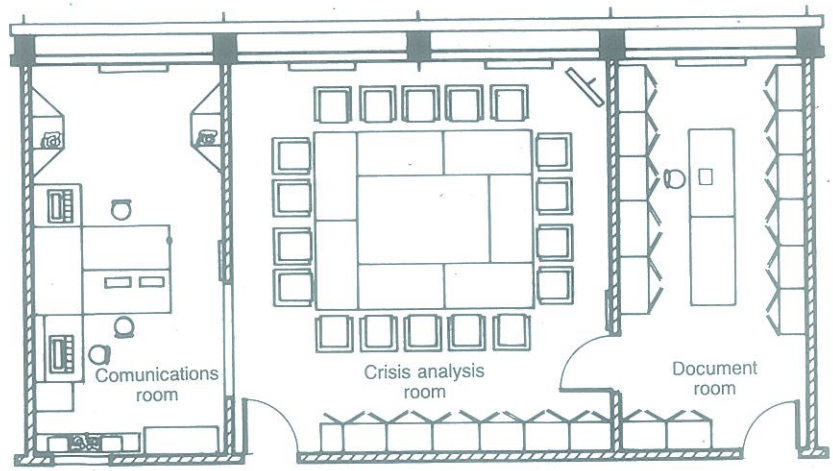
There are some six people assigned to each of the six posts of the initial crisis team, and any one expert can be assigned to more than one plant of similar characteristics.

The "on-call" group is permanently available twenty-four hours a day, and all the people assigned to each of the crisis team posts take turns on a weekly basis, which involves at the very least a cycle of six weeks and nine services per year. Since, in the event of an alarm, the group must come together within thirty minutes and at the very latest within two hours, as commented above, the members of the "on-call" group are restricted to a specific radius of activity during the week they are on duty for the group, so that if they are alerted by Eurofunk they can reach the ERC within the agreed time limit. In addition to the Eurofunk call device proper, each member owns two cartridges for this device, one in his private home and one in his work place. The group members must confirm by telephone that they have received the alarm alert from Eurofunk. If on ocassions this does not occur before 25 minutes, an attempt would be made to locate the group member in question by telephone, and if this were not possible, another standby member assigned to the crisis team would have to be summoned. Each ERC has several telephone numbers that are reserved only for the plants and do not appear in the internal telephone directories.

Insofar as the technical installations are concerned, each ERC is equipped with a telephone exchange with six lines, telecopiers, teletypes, television with video, recorders, loud speakers, etc.

To maintain communications between the plant and the ERCs, the telephone call used for the alarm alert constantly serves as the situation line. Just as the ERCs, the plants provide the ERCs with internal telephone numbers. The telecopiers and teletypes can also be supplied with emergency current, and the same as for the telephones, only the plants' crisis teams know the numbers.

The different communication possibilities in both directions between the ERCs and the plants are usually tested on a yearly basis. In addition, there are provisions for at least two test alarms per year. The auxiliary personnel and secretaries assigned to the crisis team also undergo periodic training on how to use the above indicated technical devices.



F II *Erlangen emergency response center*

Figure II shows the general arrangement of the Erlangen ERC with its three communications, crisis analysis and document rooms. This latter room contains enough technical documentation required to handle the crisis and properly advise the plant operator. Appendix B of KTA 1404 regulates and defines the technical documents that each ERC should have on hand, which are basically as follows:

- Operating manual.
- Technical specifications.
- Safety report.
- Building drawings.
- Flow diagrams and system descriptions.
- Reactor protection manual.
- Manual regarding the efficiency of the core emergency cooling system.
- Nuclear and thermohydraulic core design manual.
- Plant dynamics manual.
- Information regarding the site (site drawings, maps, communications, etc.).
- Information regarding plant organization (responsible spokesmen with telephone numbers).

All this technical documentation must be kept updated with the corresponding revisions and complementary information so as to insure that the crisis team has all the latest documentation at its disposal to fulfill its mission.

AGREEMENT BETWEEN TRILLO I NPP AND SIEMENS-KWU

Trillo I NPP and Siemens-KWU after the beginning of the commercial operation signed an agreement to exchange experiences during the operating phase and to collaborate in the event of failure or emergency. The second part falls within the framework of support in the event of emergency and mitigation of the possible consequences set forth in this description.

It is of note that the specific crisis team for Trillo I NPP includes an additional seveth member with an excellent knowledge of the Spanish language. As regards the maintenance and updating of the Trillo I NPP technical documentation in the Erlangen ERC, Siemens-KWU is in charge of the manuals concerning to reactor protection system, nuclear and thermohydraulic core design, plant dynamics, and efficiency of the emergency core cooling system, as well as of the descriptions of the systems for which it is responsible. Trillo I NPP is responsible for maintaining and updating the remaining technical documentation set forth in the preceding paragraph. Lastly, it should be noted that both parties named their valid spokesmen for the collaboration and defined the necessary warning instructions in the event of failure or emergency.