arboost TECHNOLOGIES

Kernkraftwerk Gösgen

ABS Consulting

Workshop **"Next Generation PSA Software, Declarative Modeling, and Model Representation Standards"**

MARE
a Risk Monitor supported in PSA Risk Spectrum code models

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Kernkraftwerk Göesgen-Daeniken - Switzerland

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RISK ANALYSIS MONITOR MARE

MARE is a plant specific real-time risk analysis tool developed by Empresarios Agrupados (EA) mainly to support fulfilment of the Spanish Regulatory Authority (CSN) requirement to implement the USA Maintenance Rule (10 CFR 50.56). This tool supports the analysis and evaluation of risk level changes due to equipment unavailability during plant operation.

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MARE GENERAL CHARACTERISTICS

- Monitoring of on-line plant configuration by means of direct connection to plant component outage management system
- Interface aimed at plant staff: operation, maintenance, technical , ..
- Same terminology and representation used by plant staff
- Complete PSA model calculations with powerful calculation algorithm
- No training in PSA techniques required

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MARE GENERAL CHARACTERISTICS

- Works together with Risk-Spectrum-Windows computer program and PSA models handled by this computer code. Automatic interface without PSA analyst involvement in the MARE execution.

- Modular structure easily customised to user requirements

(environmental factors, dynamic events,..)

- Display of historic, on-going and programmed outages as Gantt charts

- System configurations displayed as simplified diagrams, with different (six) colours for each possible situation

- Different displays for on-going and programmed outages

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MARE GENERAL CHARACTERISTICS

- Online mode for actual point-in-time risk monitoring
- Importance of single outage components display for multiple-component outages
- Instantaneous recovery of previously stored analysis for outage scheduling or other analysis
- Different display for point-in-time and accumulated risk
- Calculates Maximum Allowed Configuration Times (ACT´s)

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MAIN MENU OPTIONS

Aimed for different Plant Staff

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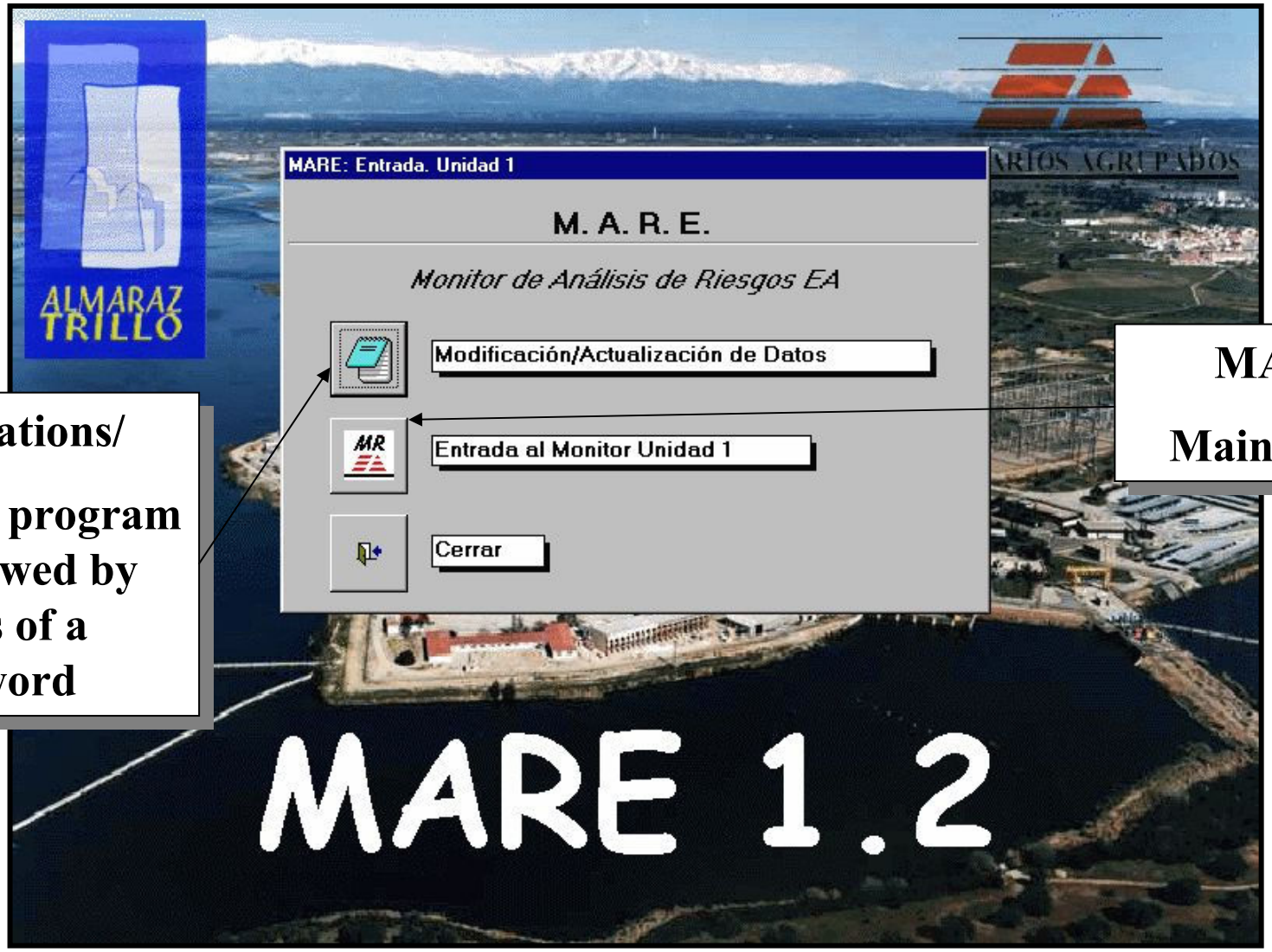
ACCESS TO THE MONITOR



Modifications/

Updates of program data allowed by means of a password

MARE

Main Menu

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MAIN MENU OPTIONS

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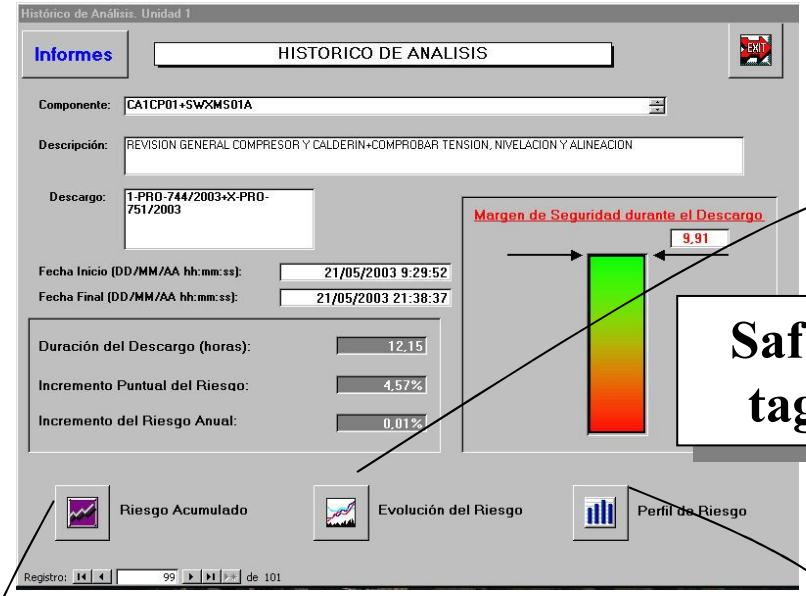
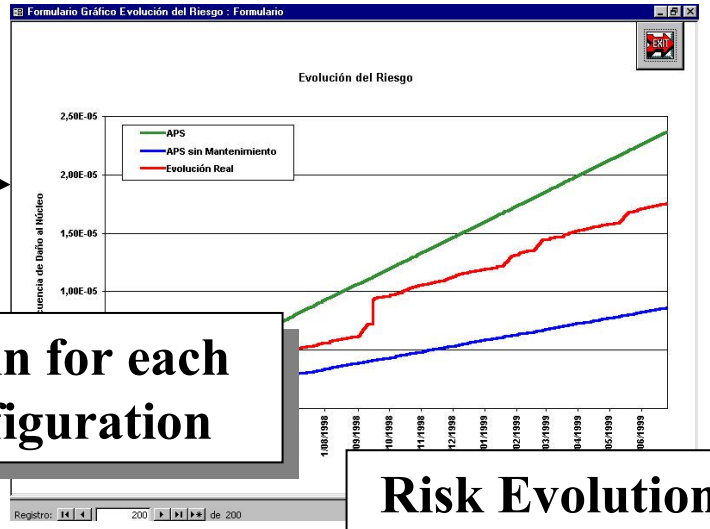
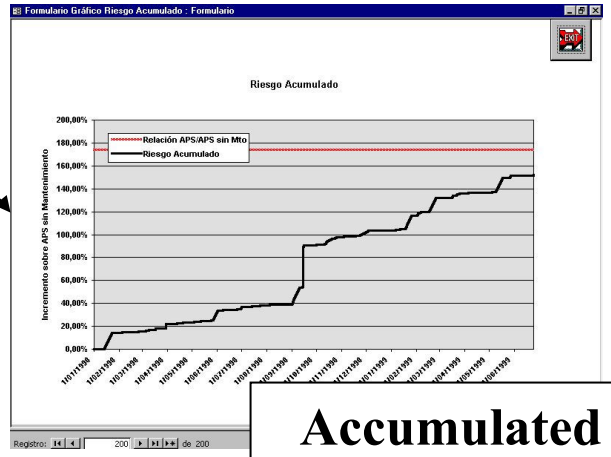
TAG-OUT HISTORICAL RECORDS



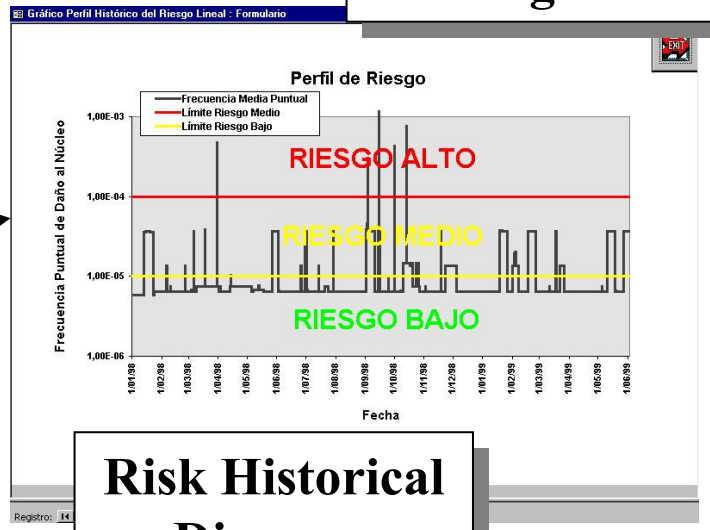


Safety margin for each tag-out configuration

Risk Evolution Diagram



Accumulated Risk Diagram



Risk Historical Diagram

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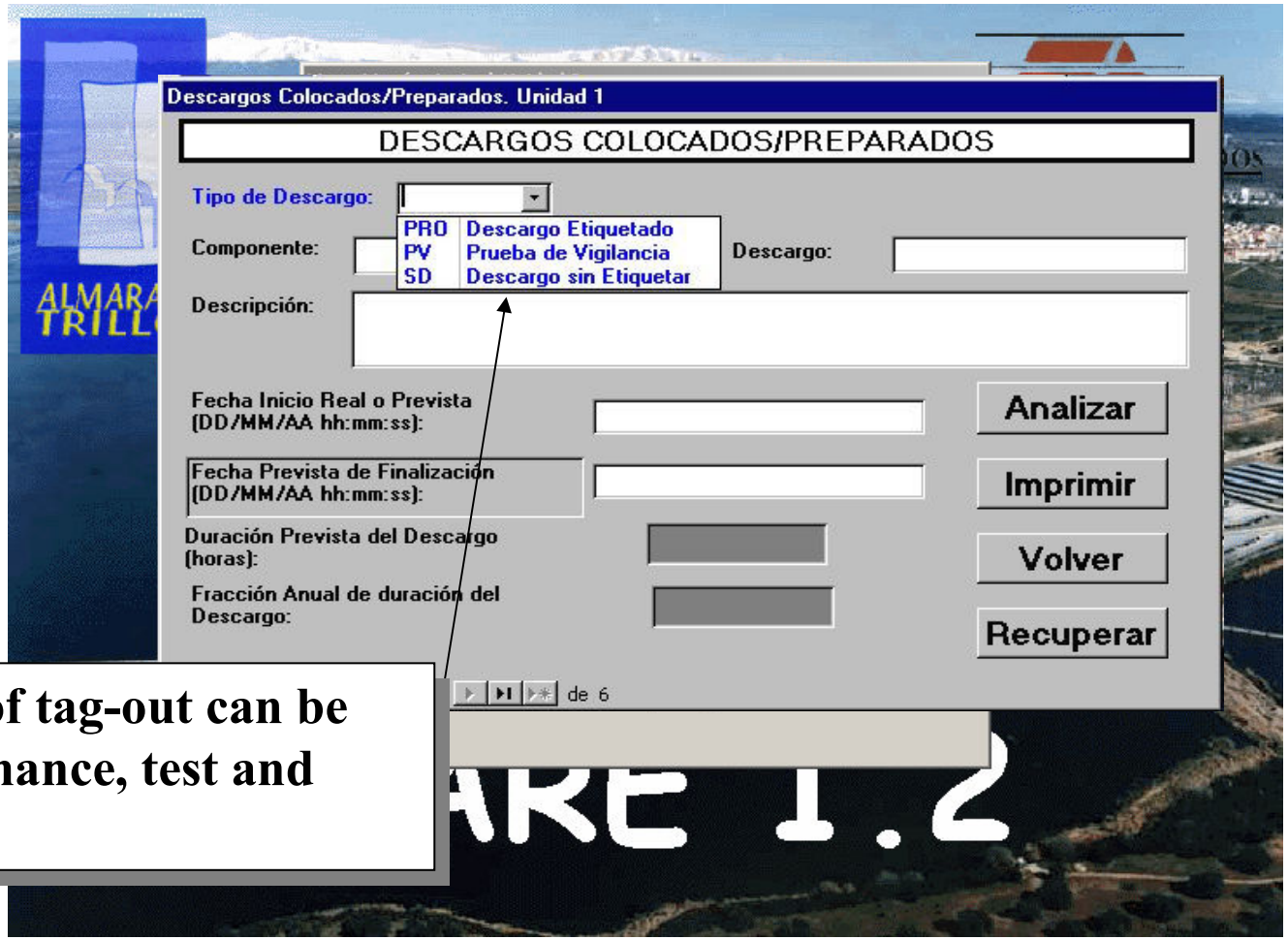
TAG-OUT HISTORICAL RECORDS



Different kinds of tag-out can be selected (maintenance, test and without labels)

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TAG-OUT HISTORICAL RECORDS

Actual risk condition of the plant is evaluated, both regarding risk accumulated since the beginning of the cycle and by displaying its evolution

Recover of previous analysis

A Report is printout listing all historical component outages along the period

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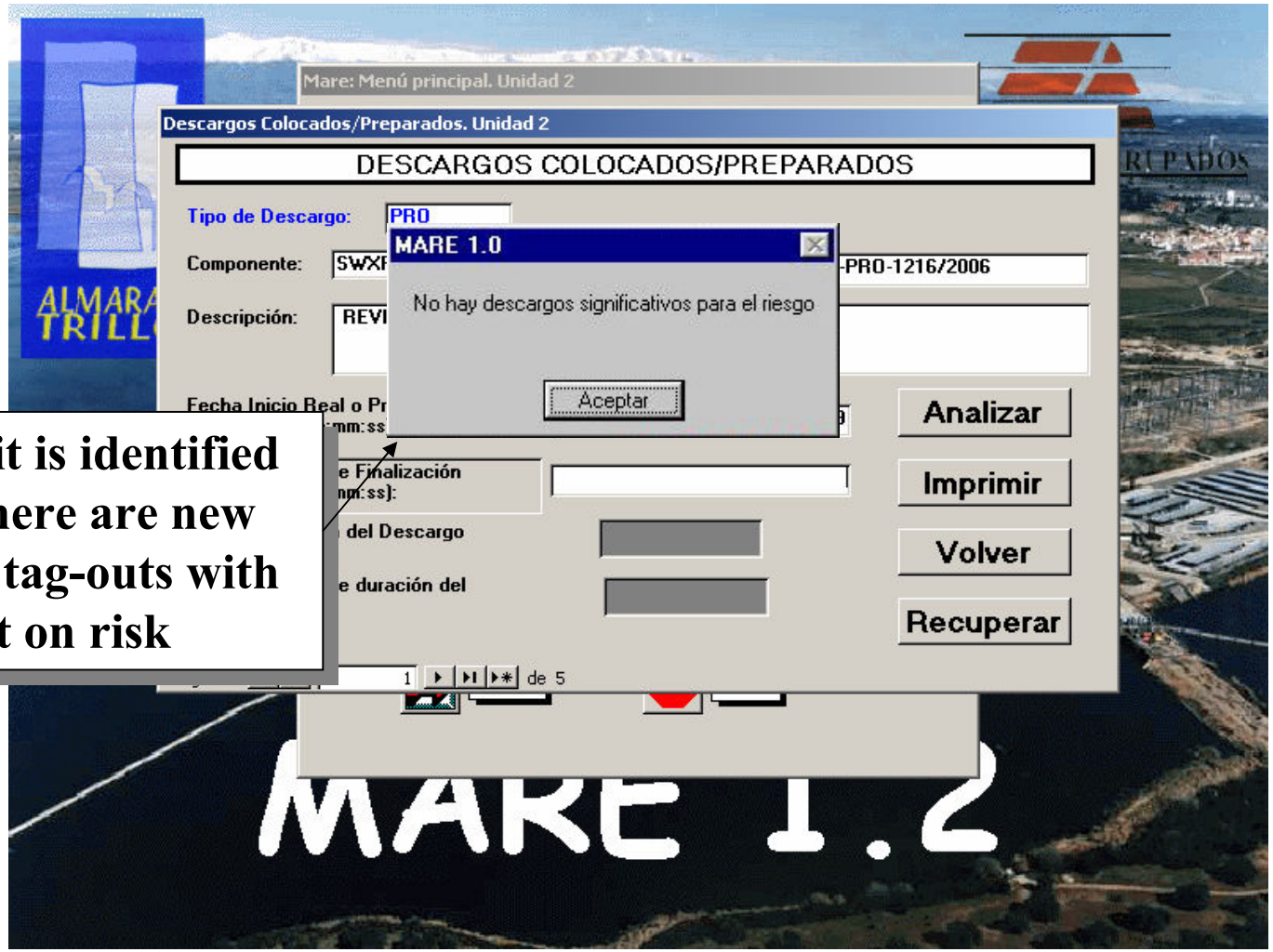
TAG-OUTS UNDER WAY/SCHEDULED



Previously it is identified whether there are new component tag-outs with impact on risk

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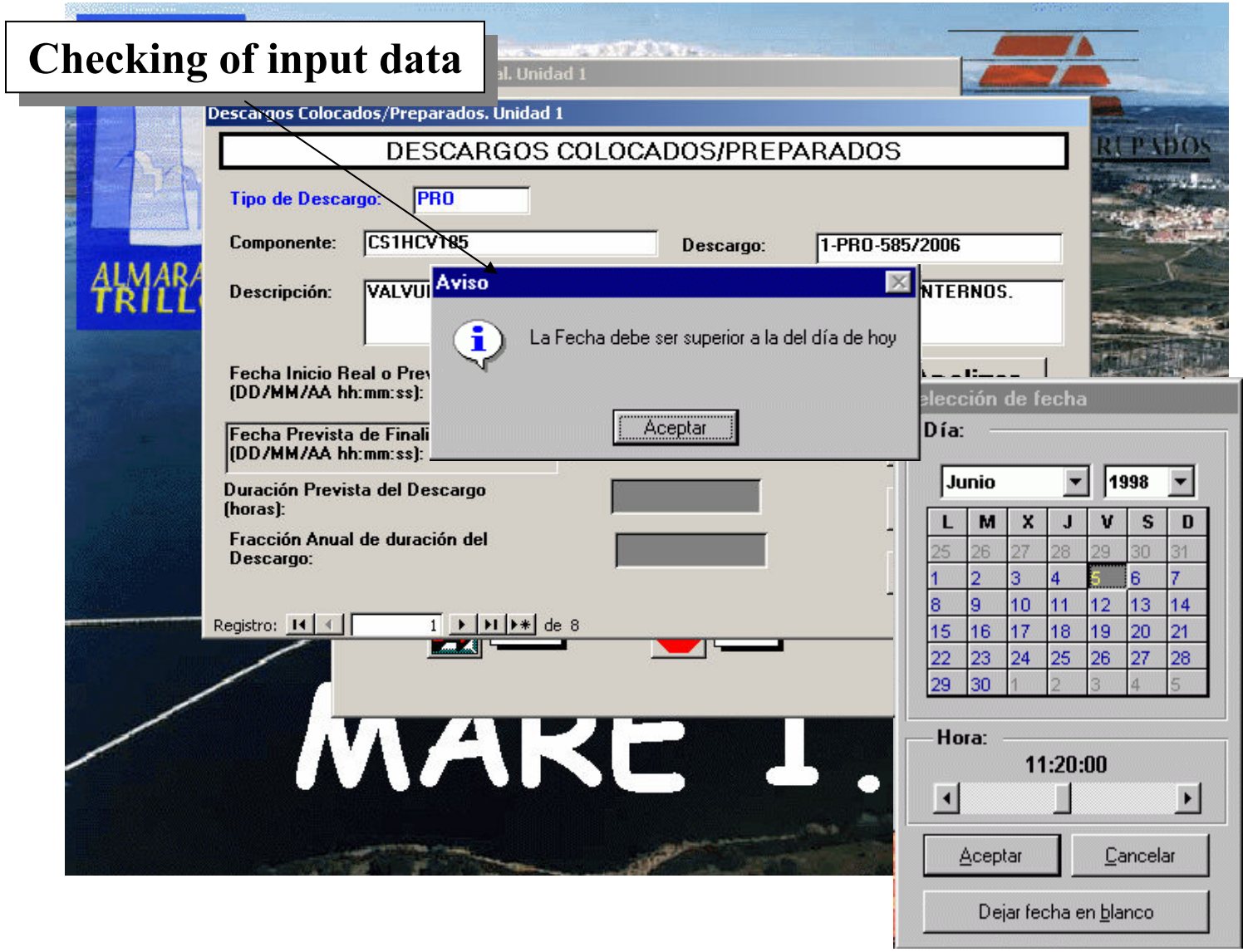
TAG-OUTS UNDER WAY/SCHEDULED



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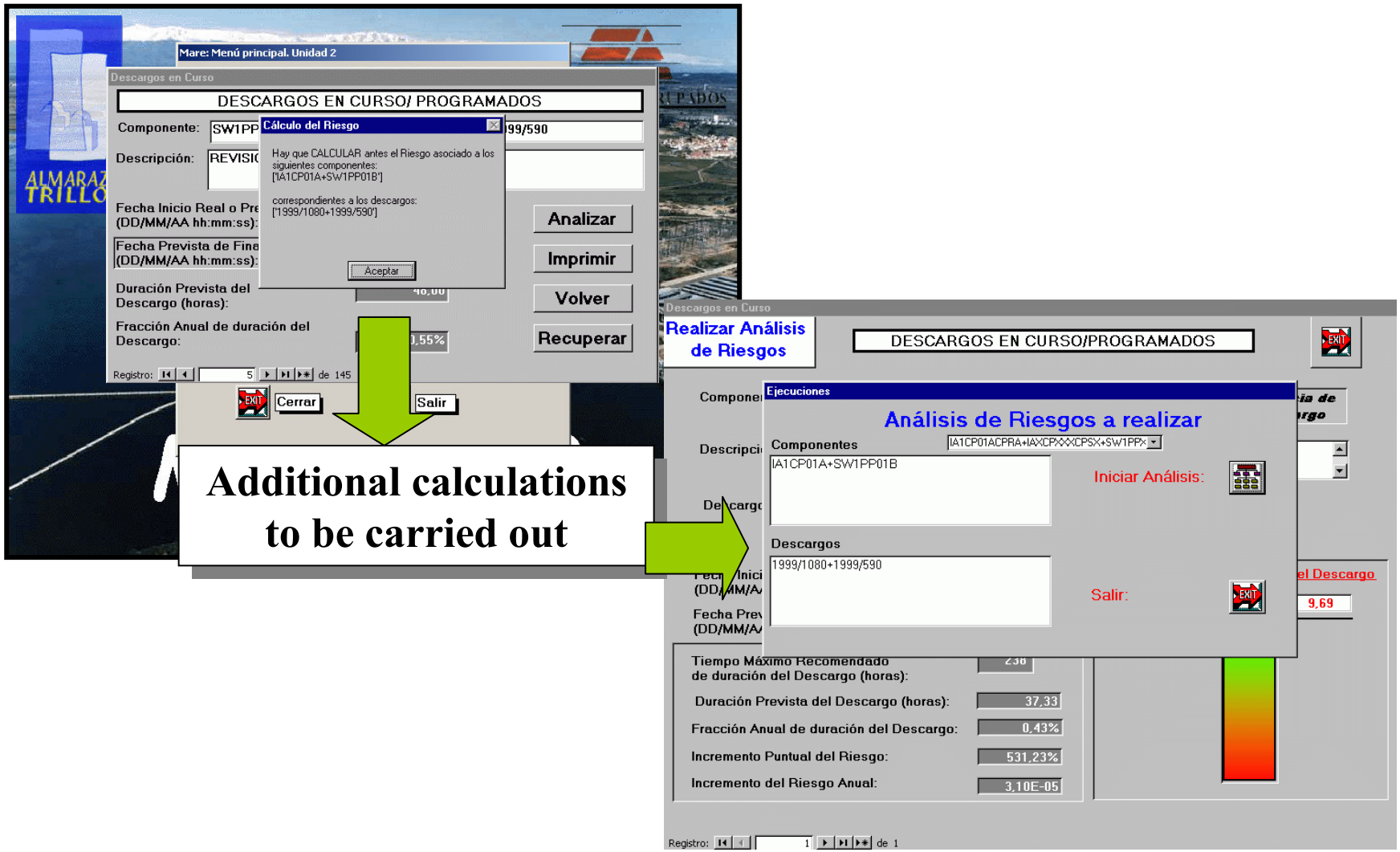
TAG-OUTS UNDER WAY/SCHEDULED



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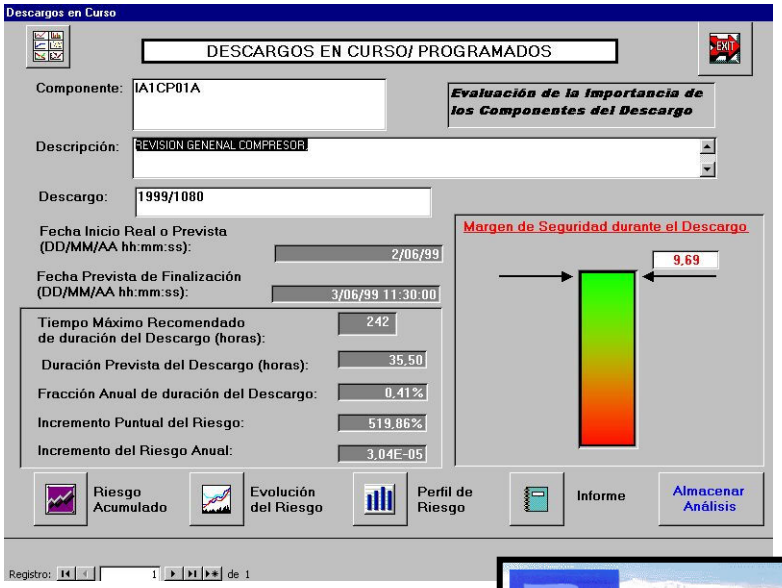
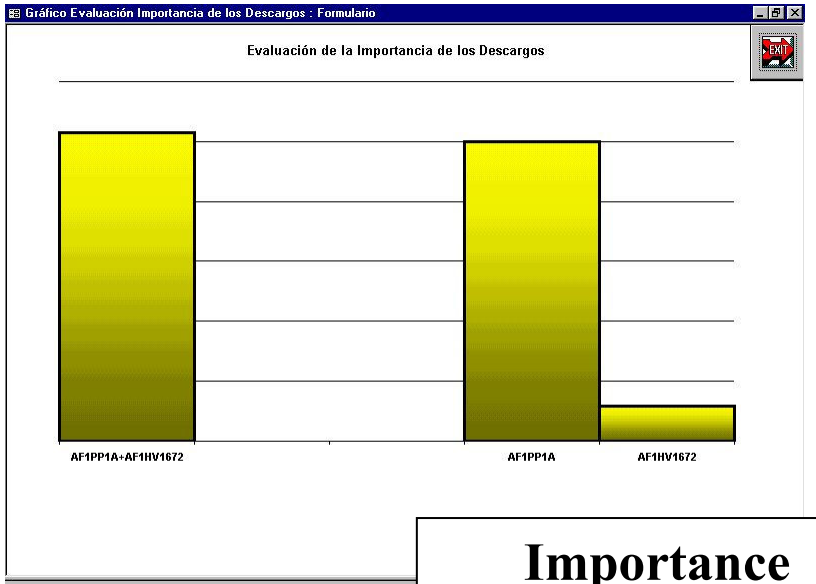
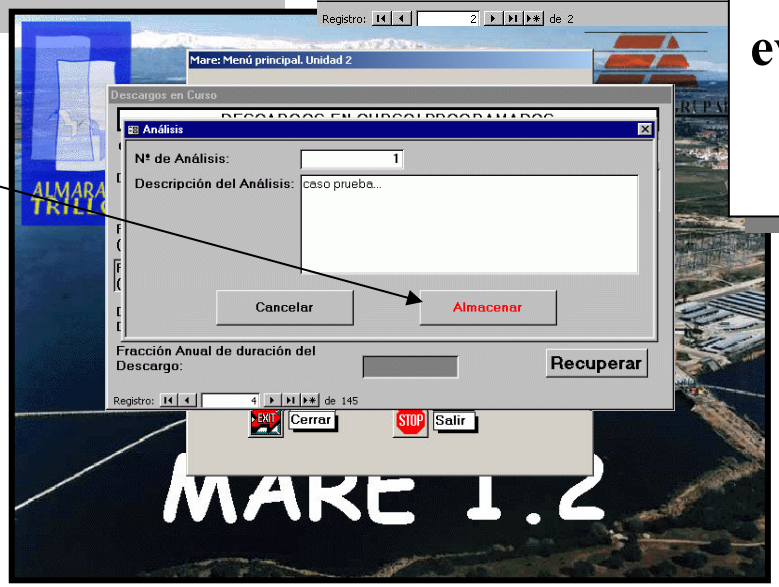
TAG-OUTS UNDER WAY/SCHEDULED





Importance evaluation of single Tag-out components

Filing of new hypothetical configuration analysed



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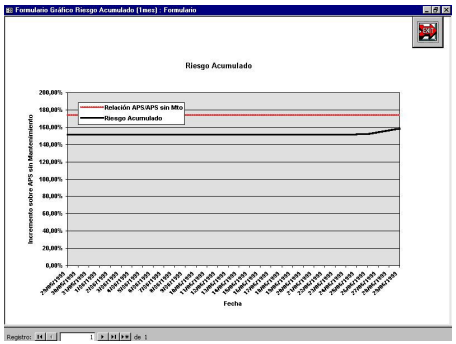
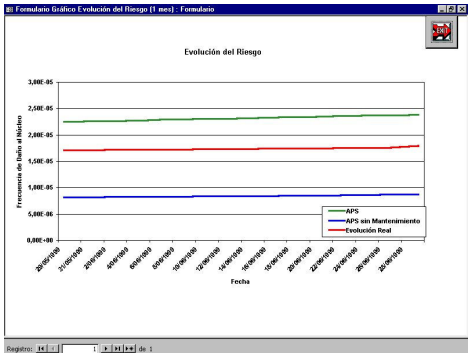
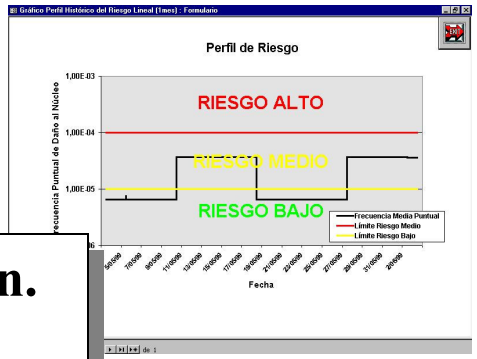
TAG-OUTS UNDER WAY/SCHEDULED

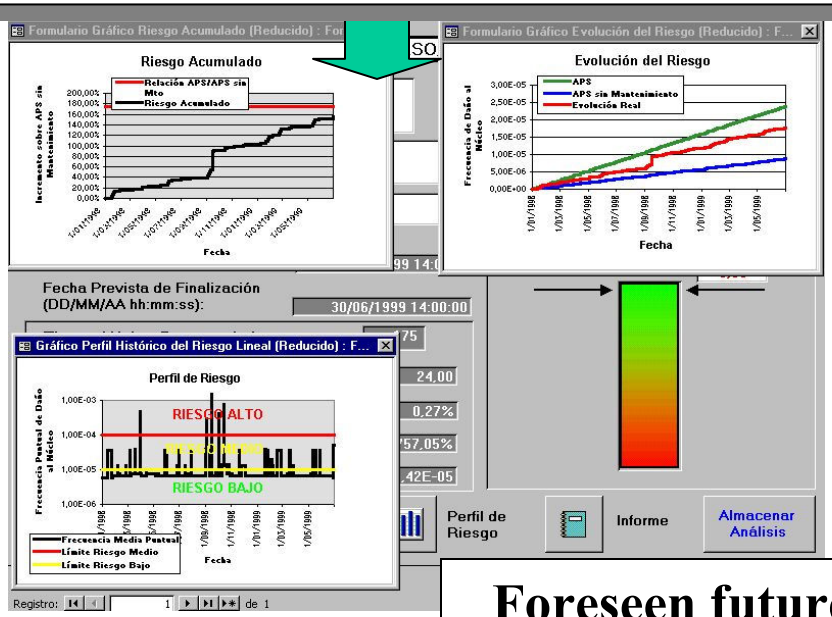
Different views of the results are available







Joint display of results: safety margin and historical evolution along the period analysed



Foreseen future risk evolution. Next month is displayed

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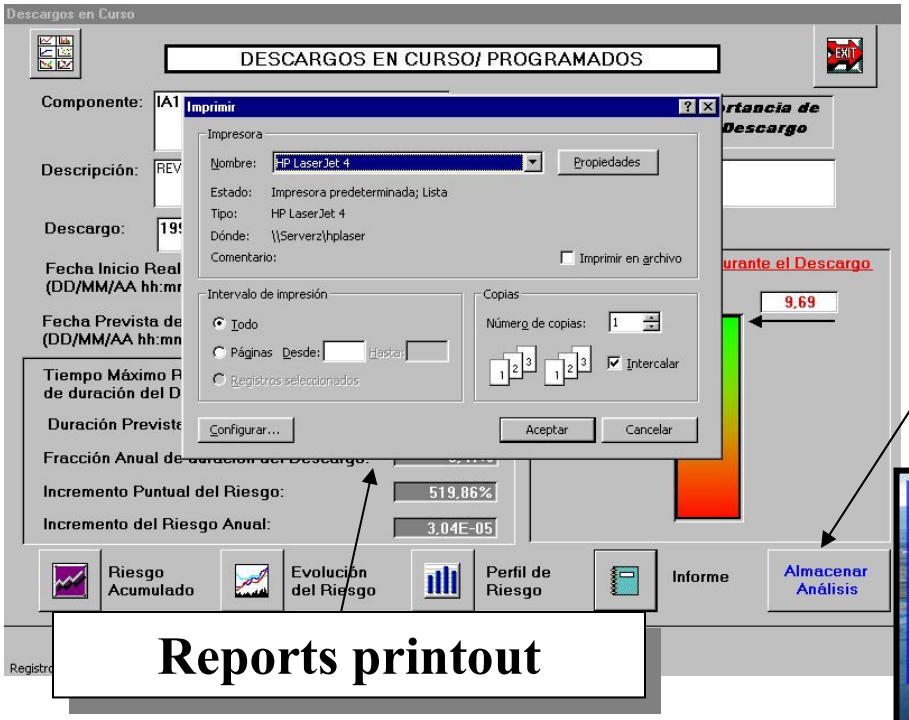
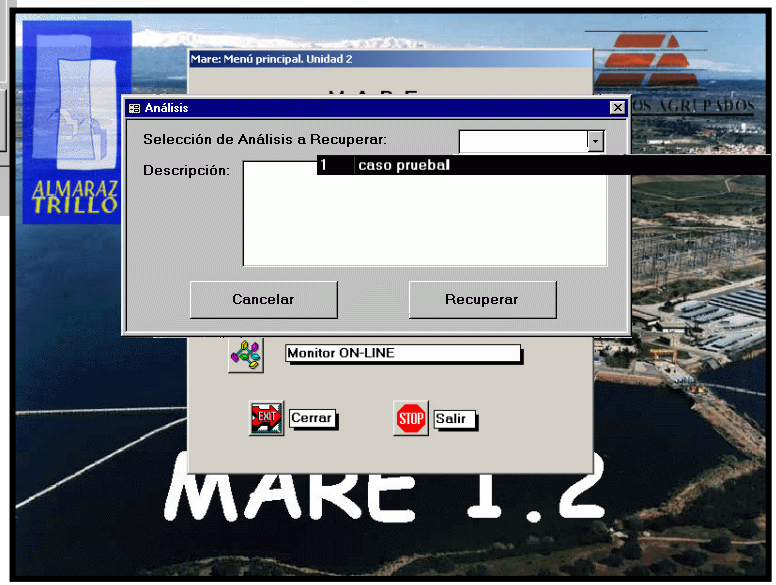
TAG-OUTS UNDER WAY/SCHEDULED



Reports printout

Filing of analysed cases is possible. That permits future recovery or comparison with other analysis



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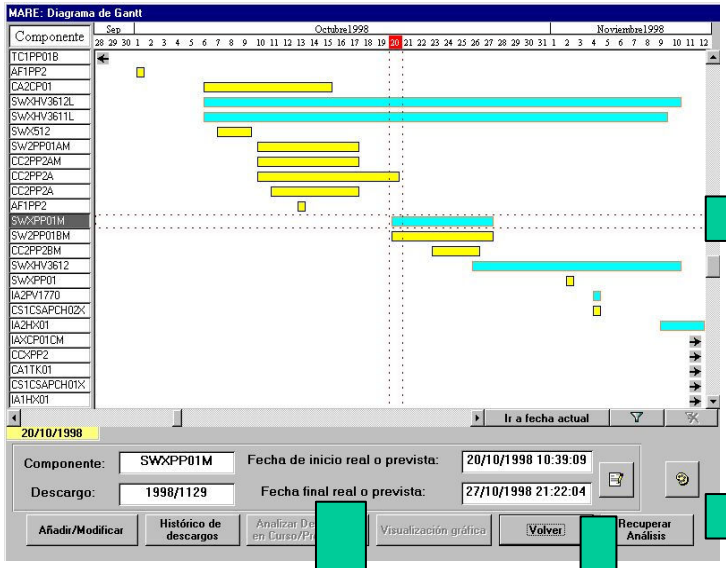
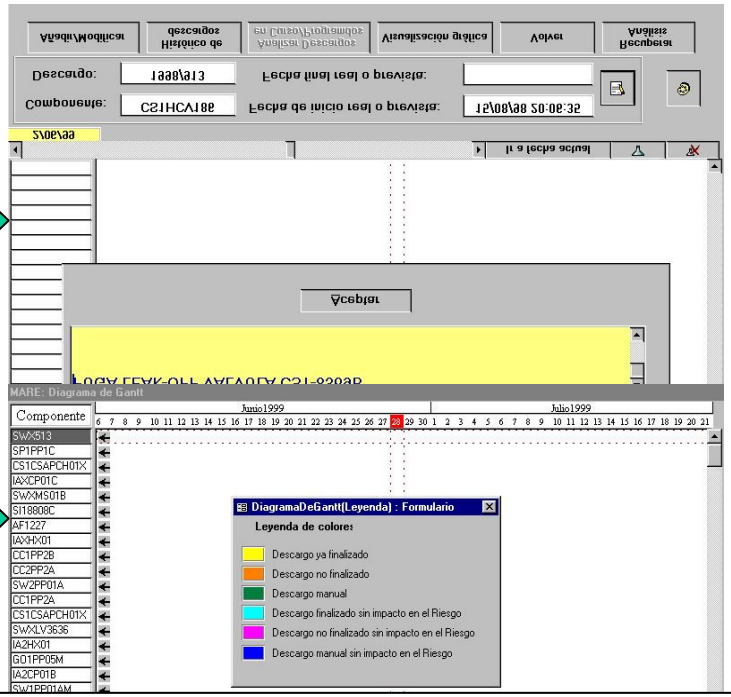
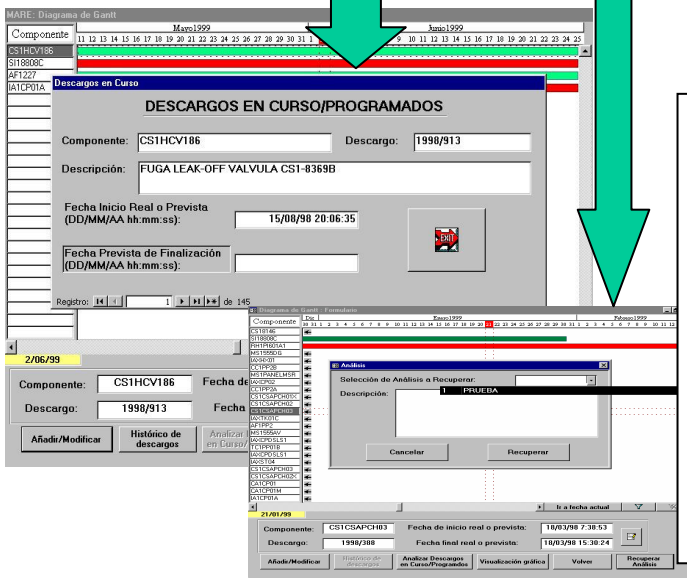
GANTT DIAGRAM







Tag-out display in a Gantt Diagram:

Status of tag-outs: historical and under way

Input tag-out data

Scheduling of new Tag-outs

Recovery and modification of stored analysis cases

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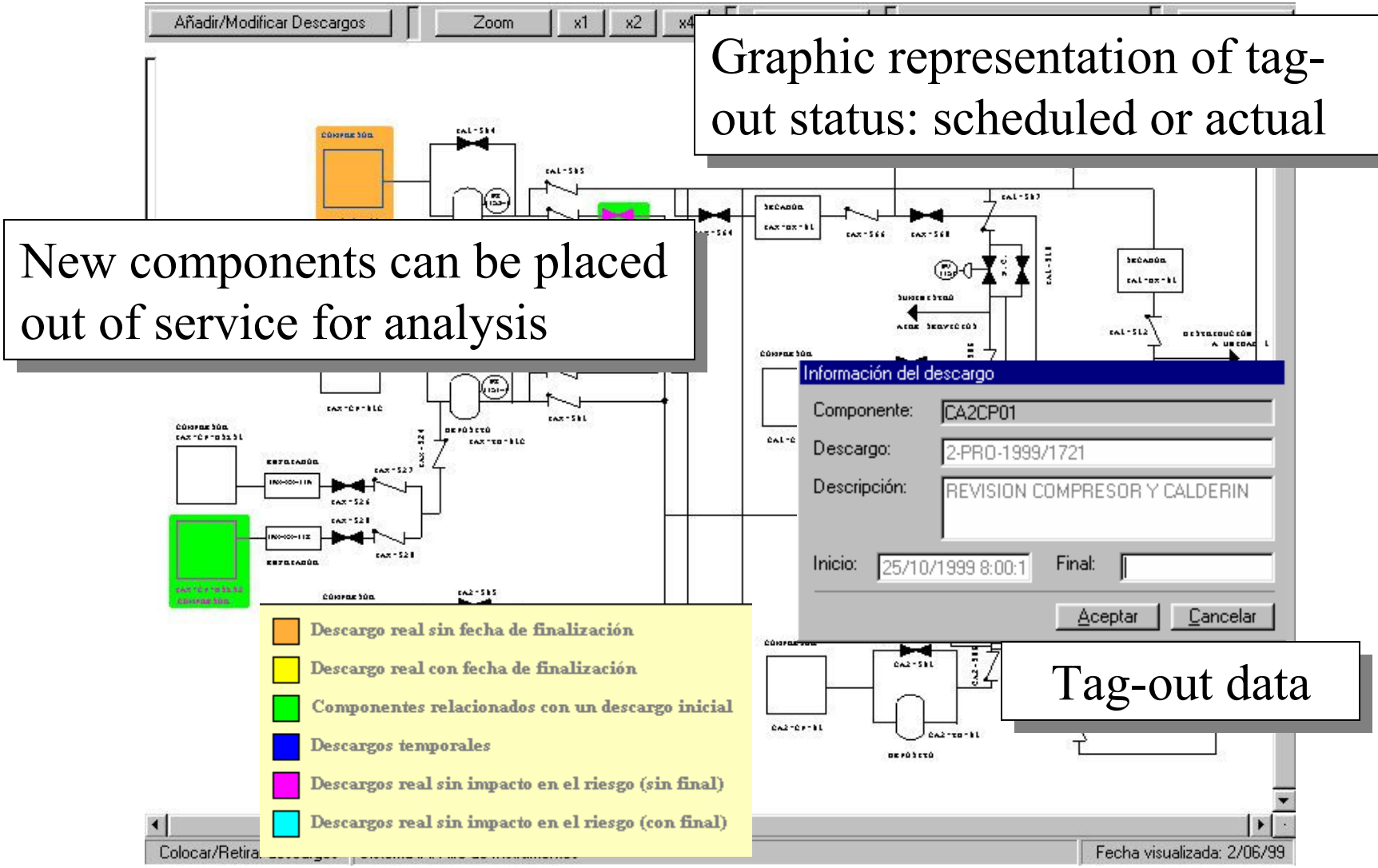
GRAPHIC DISPLAY



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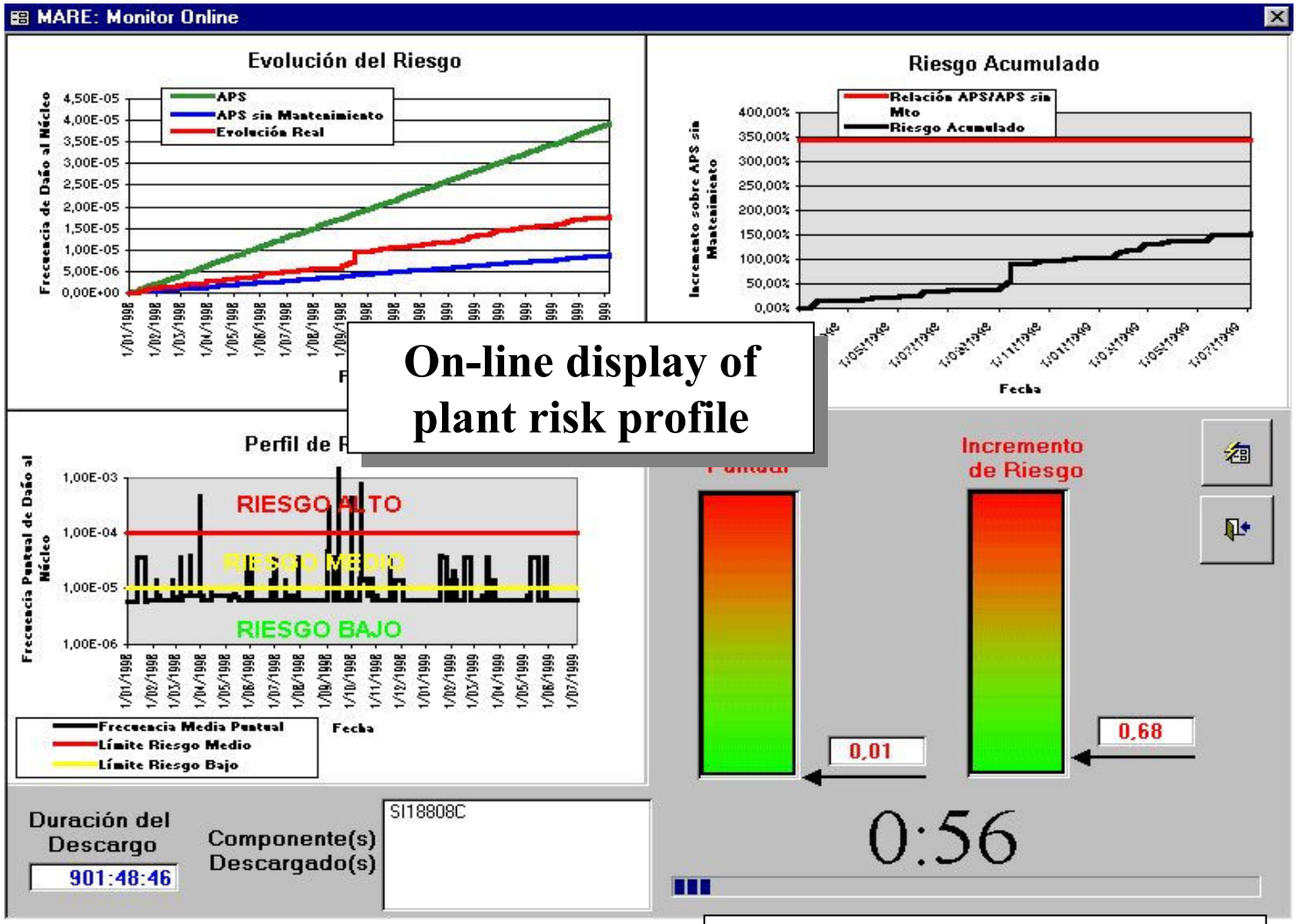
ON-LINE MONITOR



On-line display of plant risk profile

Data is automatically refreshed every X minutes

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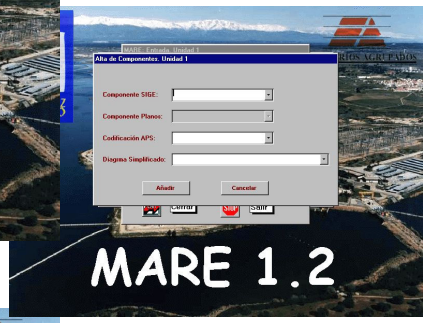
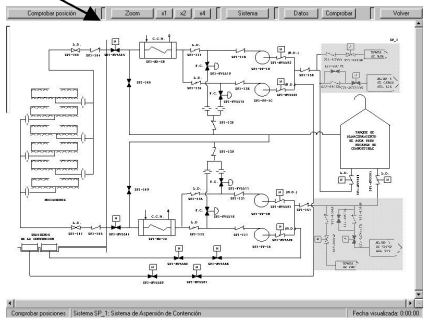
DATA MODIFICATION

All data used can be modified:

- Constants
- Input data
- Flow diagrams





Modifications require a password to avoid mistakes

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MARE IN ALMARAZ NPP

- Real time Risk Monitoring integrated with SIGE plant database
- Complete solution of each unit PSA model (no simplifications)
- Full power Level 1 PSA
- Automatic maintenance data plant inputs from SIGE database
- Updates of design modifications and reliability data each refuelling
- Useful reports and graphics capabilities for MR and others

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MARE IN ALMARAZ NPP

- Three different user friendly interface displays for operation, maintenance and technical assistance staff.
- Simplified diagrams (same as used in PSA) and unfoldable menus with the same component representation and identification than in plant
- Special information for both units shared components
- Normal on-line risk calculations in less than few minutes