

# ESIM-DEE1 Drilling Emergency Exercise Simulation Training System

## Technical Specification

## ■ 1. Introduction

ESIM-DEE1 drilling emergency exercise simulation training system is a set of software for drilling practitioners to improve their capability of emergency management and it can be used for training and assessment of emergency exercise. This system, taking the emergency handling of typical incidents in drilling operation as the core and based on the emergency plan for drilling emergencies, simulates the process of drilling emergency exercise, receives the emergency handling operation of the trainee, and judges the personnel's handling operation according to the emergency plan. Through the system, the trainees can correctly prejudge the on-site situation, participate in the training of emergency handling and emergency escape in the face of drilling incidents, thereby improving the personnel's emergency response capability.

- (1) The system is developed from the mainstream 3D graphics engine. It can simulate the drill scenario, equipment and facilities, personnel situation, environmental conditions, the process of the incident occurrence and development through 3D simulation technology and 3D interaction technique, to realize the simulation and 3D interaction of the personnel emergency handling process.
- (2) The system can be used to carry out the simulation of emergency exercise for typical incidents of drilling and conduct the single-person exercise and multi-person joint exercise for trainees. It can automatically evaluate personnel's emergency handling, emergency handling, professional skills, individual protection and emergency knowledge of the participating trainees.
- (3) The system supports the plan editing function so that the user can edit the plan

according to the plan format to adapt to the change of the on-site emergency requirements. The edited plan can be directly applied to the drill operation to develop a new evaluation standard.

- (4) The system has the function of drill configuration, which can customize the emergency drill process. Based on 3D visualization, it can realize the configuration of emergency exercise related scenes, environmental parameters, events, drill process, functional tasks, etc., to meet individualized and customized requirement of emergency handling.
- (5) The exercise process is controlled and managed by the instructor in a unified manner. Instructors can use the instructor-side software to manage the information of trainees, arrange the drill subjects and the drill process and make the emergency plan. Instructors send arranged exercise plan to the student side, and the trainees can exercise according to the plan.
- (6) The system supports demonstration mode, practice mode and assessment mode, which can be applied to the whole process from teaching, learning, to training assessment.

## ■ 2. System Component

The drilling emergency exercise simulation training system is divided into three parts: the server side, the instructor side, and the student side. The modules are as follows:

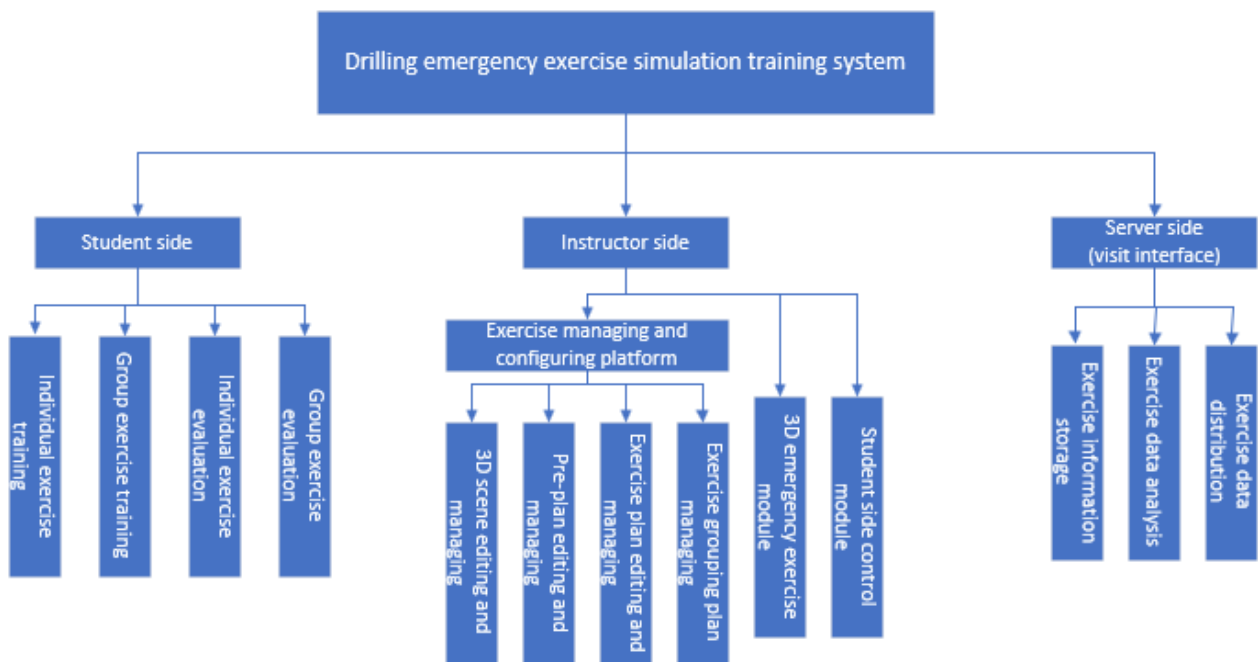


Figure 1 Drilling emergency exercise simulation training system function module

### ■ 3. System Function

#### ■ 3.1 Student Side

It is used for exercise activities of trainees with single and multi-person exercise modes.

Trainees can log in through the account. The specific functions include:

- (1) Post and role selection: trainees can choose the post and role to carry out simulation exercise, including 5 teams and 12 exercise posts.

- Management group

Post: driller, assistant driller, mud man, lead tong man, backup tong man, derrick monkey, recorder, roustabout.

- Command group

- Alert group

- Emergency group

- Medical group

- (2) Personal protection and device detection

- Protective equipment to be selected for normal operation in the well site
- Equipment status inspection related to emergency process under normal operation
- Emergency equipment inspection

### (3) Exercise plan setting

The students who created the room set the parameters of the plan, including the initialization status of the well site; whether there were incidents like explosions, overflows, H<sub>2</sub>S leaks; wind direction, wind speed, etc. The parameters setting will directly affect the handling of various incidents in the exercise scenario.

### (4) Emergency exercise

- Individual exercise: the individual exercise is a single-user operation exercise. The user can directly select individual exercise mode after entering. By selecting the exercise incidents type and exercise posts (multi-positions are optional), clicking the start, you can enter the project to start a single exercise. Under the single-player mode, other post, except the selected ones, are automatically replaced by computers.
- Team exercise: team training is a multi-person collaborative joint exercise. The user first selects the incident type and creates an exercise, and then, other LAN users can see the created room and the incident type. After the user enters, they can choose exercise posts (multiple positions are optional) and start a multi-person joint exercise. In the multi-person joint exercise mode, multiple people need to cooperate in the emergency handling simulation exercise to complete the task and collaborative operation. At the same time, the characters not selected by the users are automatically replaced by the computer.

### (5) Emergency handling

It trains and assesses the trainees' mastery of emergency response knowledge in the form of answering system, and it supports knowledge classification, examination question importing, and test plan (number of questions and score) setting.

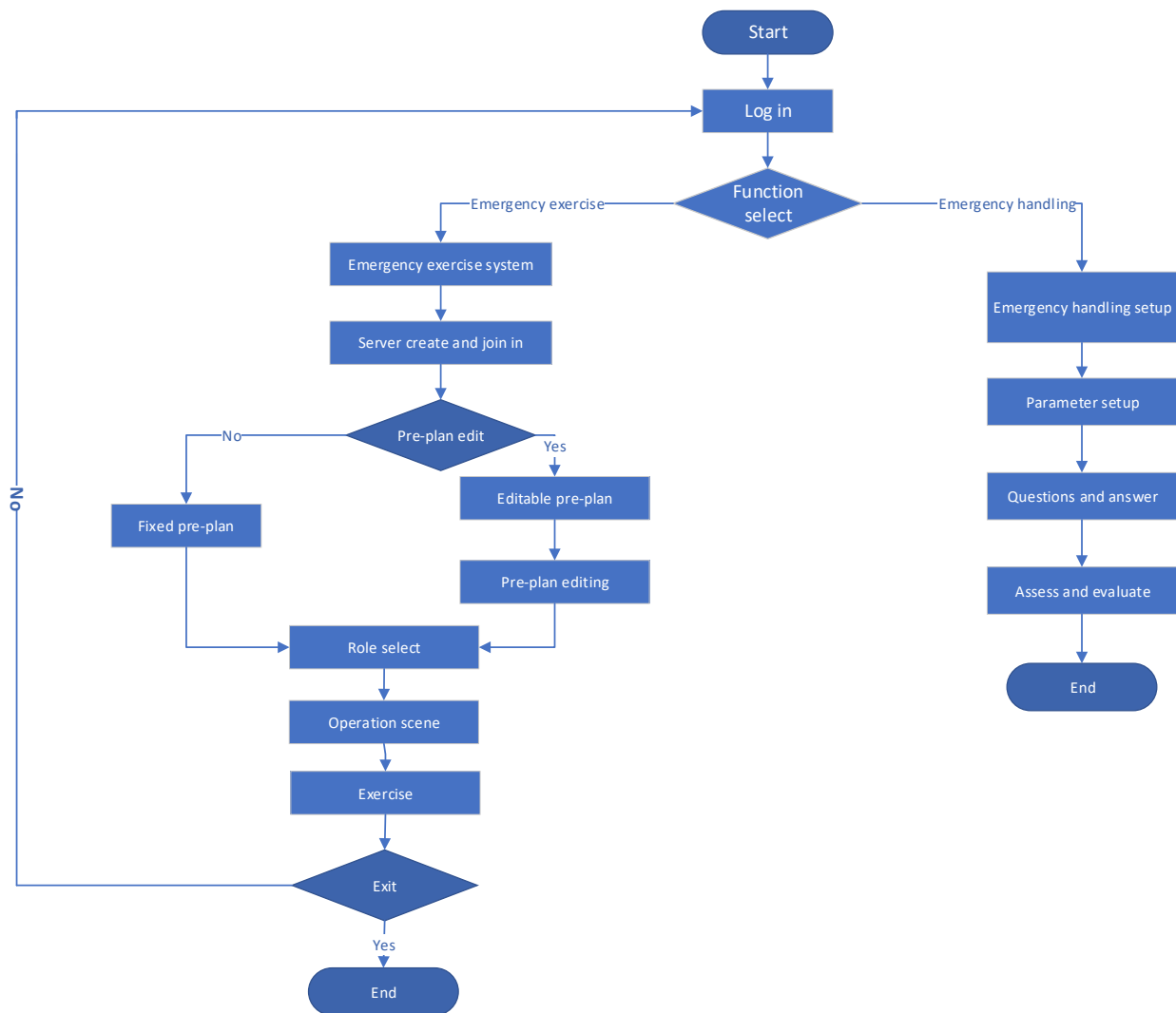


Figure 2 Student-side process

### ■ 3.2 Instructor-side

The configuration and management of the emergency exercise process and customized training exercise can be realized through the instructor-side software to carry out exercise training. The configurable items include: grouping plan, exercise plan (exercise project, incident parameters), exercise scenario, and emergency pre-arranged plan. It can conduct the operation and management of basic data information, which include: student information, instructor information, class information, project assessment information, operation records, statistical analysis of data, etc. It can provide data services for system clients to ensure normal call and real-time recording of operational data information.

Instructor-side software module includes:

#### (1) Emergency exercise management configuration platform

The emergency exercise management configuration platform can realize the

customization of the emergency exercise process and complete the configuration of various parameters such as related scenario, environmental parameters, events, exercise process, functions and tasks, etc. The emergency exercise configuration platform possesses perfect emergency exercise resources, which can support emergency exercise configuration. At the same time, it needs to be modularized and easy to use. These features enable instructors to perform emergency exercise editing and configuration more easily and quickly.

- 3D scene editing and management
  - a) Provide a 3D drilling scenario version
  - b) In the visual view box, call model resources or scene templates to quickly build a 3d scene
    - 3D model
    - Post role
    - Emergency supplies
    - Risk point
    - Disaster scene
    - Drilling motion path
    - Drilling action
    - Close-up perspective of drilling
    - Environmental parameter of drilling
    - Common video of drilling
- Editing and management of pre-arranged exercise plan
  - a) The system will supply packaged exercise plan
  - b) The users can conduct configuration and management of the exercise sequence、exercise process and logical relationship among incidents (e.g. causality, parallel relationship and serial relationship).
  - c) The system supports the score setting of the exercise task, and it can realize the assessment and evaluation through the score setting during the exercise process.
- Editing and management of exercise plan

a) Exercise project setting

Mode selection: single incident, mixed incidents, deduction mode

The exercise project can be used for training of both single incident handling and multiple incidents handling.

In the deduction mode, according to the actual situation of trainees' operation, the system will automatically judge and trigger a more serious incident, and the emergency handling process will be upgraded accordingly.

b) Incident parameter setting

c) Exercise scene setting

d) Pre-arranged exercise plan setting

e) Exercise mode setting

● Grouping scheme setting

a) Providing a quick grouping function to assign trainees to exercise groups

b) Supporting functions of manual grouping, inter-group deployment and roles change.

c) Supporting grouping schemes saving and affirmative schemes can be reused multiple times.

2) 3D emergency exercise module

Its exercise functions are consistent with the student-side ones. It is used for demonstration and teaching for instructors.

a) Post role selection: the trainees can select the post role to perform the simulation exercise.

b) The single-player exercise is a single-user operation exercise. The single-player can directly select exercise mode after entering. By selecting exercise type, the user can select the exercise post (multi-post optional), and clicking the start to enter the program to start a single exercise. In the single-player mode, in addition to the selected drill positions, other post operations are automatically replaced by computers.

3) Student-side control module

a) Exercise project distribution: assign project exercise plan according to the grouping scheme



- b) Student PC management: to configurate and manage student PC inside the LAN according to the IP, and to add and delete student PC. The system has the management authority of student PC, which can prohibit, interrupt, and open the operation of student PC.
- c) Operating information tracking: to record student-side exercise information and summarize and analyze results.

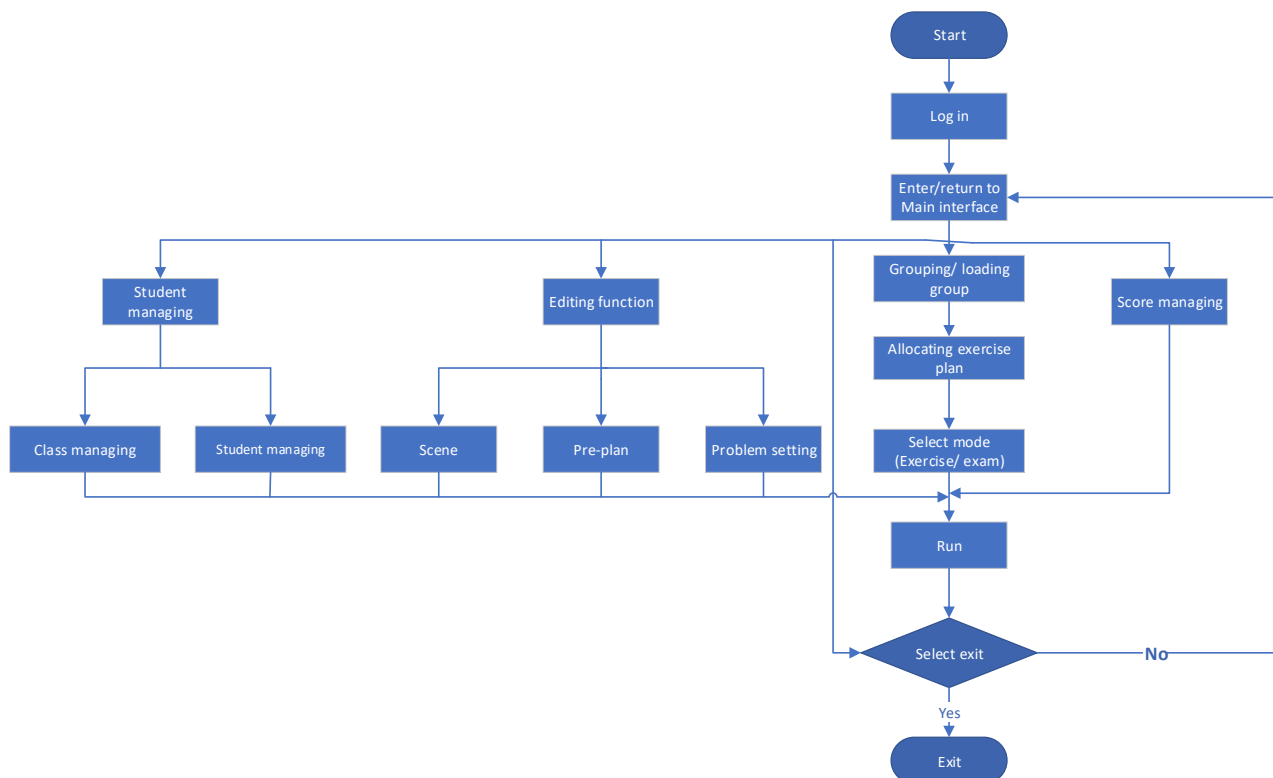


Figure 3 Instructor process

### ■ 3.3 Server side

The server side is used for the storage and management of basic data (trainee information, instructor information, class information, system test site information, etc.), system operation records, student exercise files, data statistical analysis, etc., which are related to drilling emergency exercise simulation training system. And the system provides data services for the client side, guaranteeing normal call and real-time recording of operational data. The server side is integrated with the integrated management platform for emergency training exercise, which can be maintained and managed through the 3D simulation subsystem back-stage management of the integrated management platform.

### ■ 4. Achievable exercise projects

(1) Out-of-control blowout emergency exercise handling and escape

- Drilling operation (hard shut-in)
- Tripping pipe operation (hard shut-in)
- Tripping collar operation (hard shut-in)
- Barren hole operation (hard shut-in)
- Drilling operation (soft shut-in)
- Tripping pipe operation (soft shut-in)
- Tripping collar operation (soft shut-in)
- Barren hole operation (soft shut-in)

(2) Hydrogen-sulfide leakage and toxicosis

- Drilling operation (hard shut-in)
- Tripping pipe operation (hard shut-in)
- Tripping collar operation (hard shut-in)
- Barren hole operation (hard shut-in)
- Drilling operation (soft shut-in)
- Tripping pipe operation (soft shut-in)
- Tripping collar operation (soft shut-in)
- Barren hole operation (soft shut-in)

(3) Firing and explosion emergency handling and escape

- Drilling operation (hard shut-in)
- Tripping pipe operation (hard shut-in)
- Tripping collar operation (hard shut-in)
- Barren hole operation (hard shut-in)
- Drilling operation (soft shut-in)
- Tripping pipe operation (soft shut-in)
- Tripping collar operation (soft shut-in)
- Barren hole operation (soft shut-in)

(4) Comprehensive exercise

- Tripping pipe operation (hard shut-in)

- Tripping collar operation (hard shut-in)
- Barren hole operation (hard shut-in)
- Drilling operation (soft shut-in)
- Tripping pipe operation (soft shut-in)
- Tripping collar operation (soft shut-in)
- Barren hole operation (soft shut-in)

(5) Knowledge and skill of emergency handling

- Fire
- Electric shock
- Mechanical injury
- Self and mutual medical aid

■ **5 Program operation interfaces**

(1) Login

The user enters the system after successful verification with ID number and password. If the input is wrong, the user will be prompted to re-enter.

Using the user-privileged login mode, after the instructor and the student log in, the system activates different application modules according to the permissions.



Figure 4 Login interface

(2) Instructor-side interface



Figure 5 Instructor-side system main interface



Figure 6 Instructor-side exercise setting



Figure 7 3D Scene Editor



Figure 8 Operating mode of instructor instruction system



Figure 9 Statistics

(3) Student-side interface:



Figure 10 Student-side parameter setting of exercise projects





Figure 11 Character groups selection interface



Figure 12 Handling groups selection interface

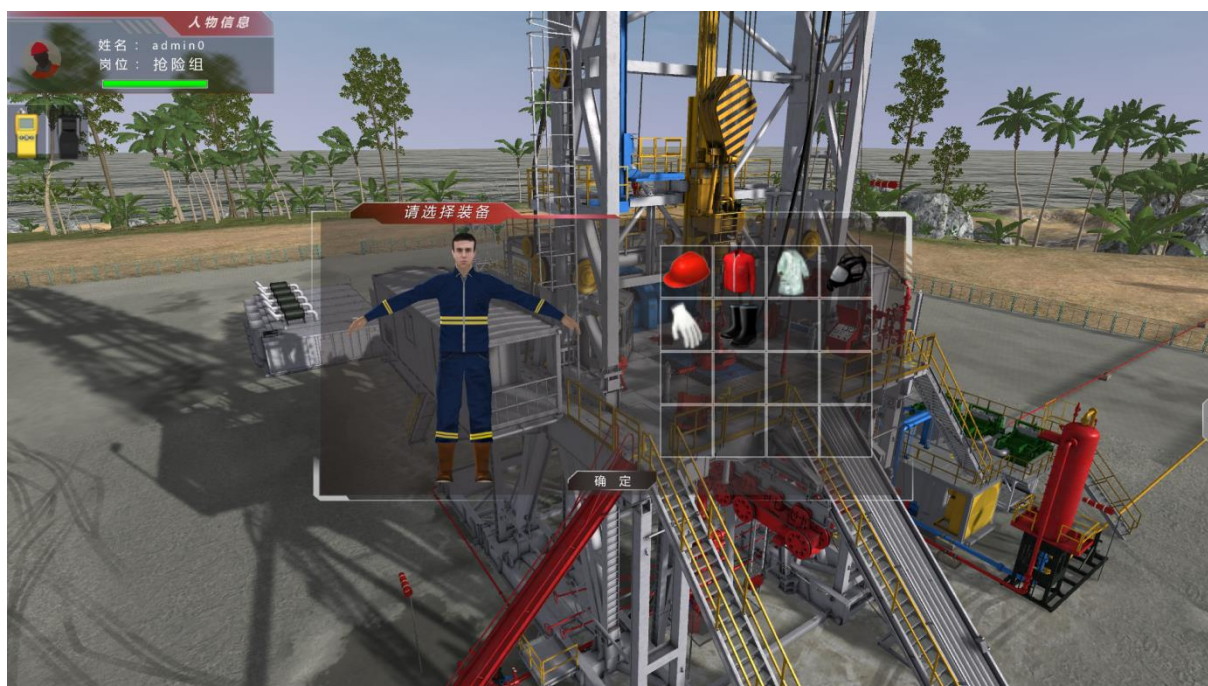


Figure 13 Personal protective equipment selection



Figure 1 Entrance equipment inspection



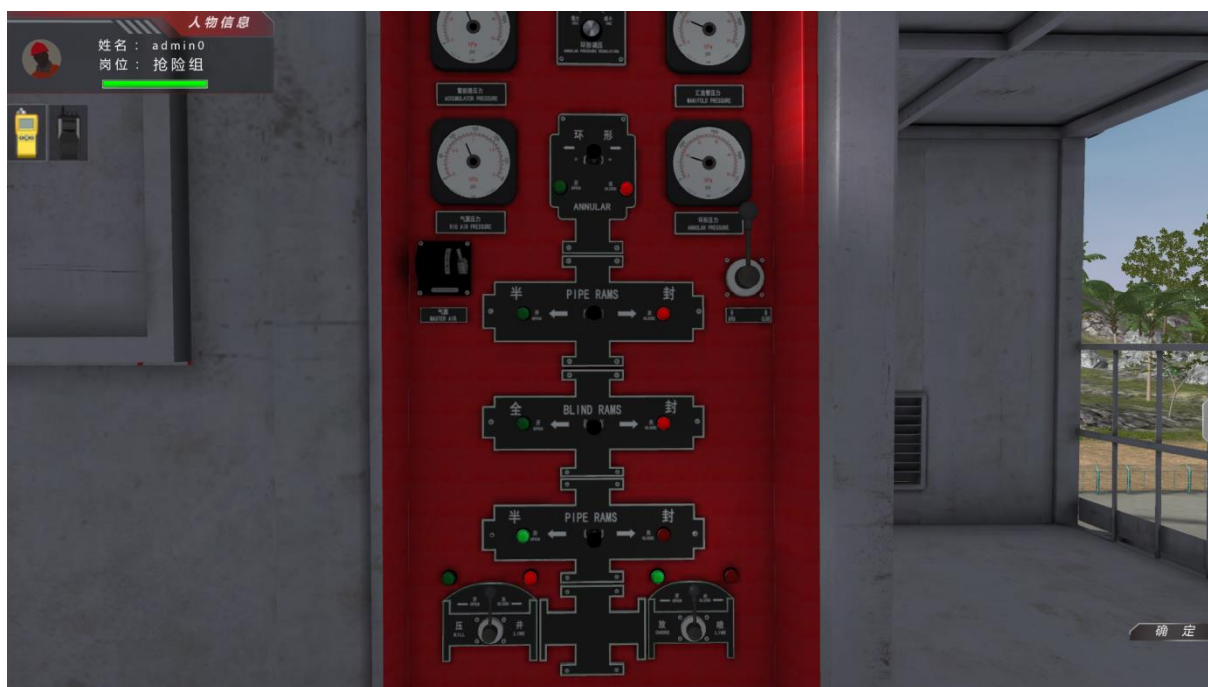


Figure 2 BOP status checking interface



Figure 3 Positive respirator inspection interface

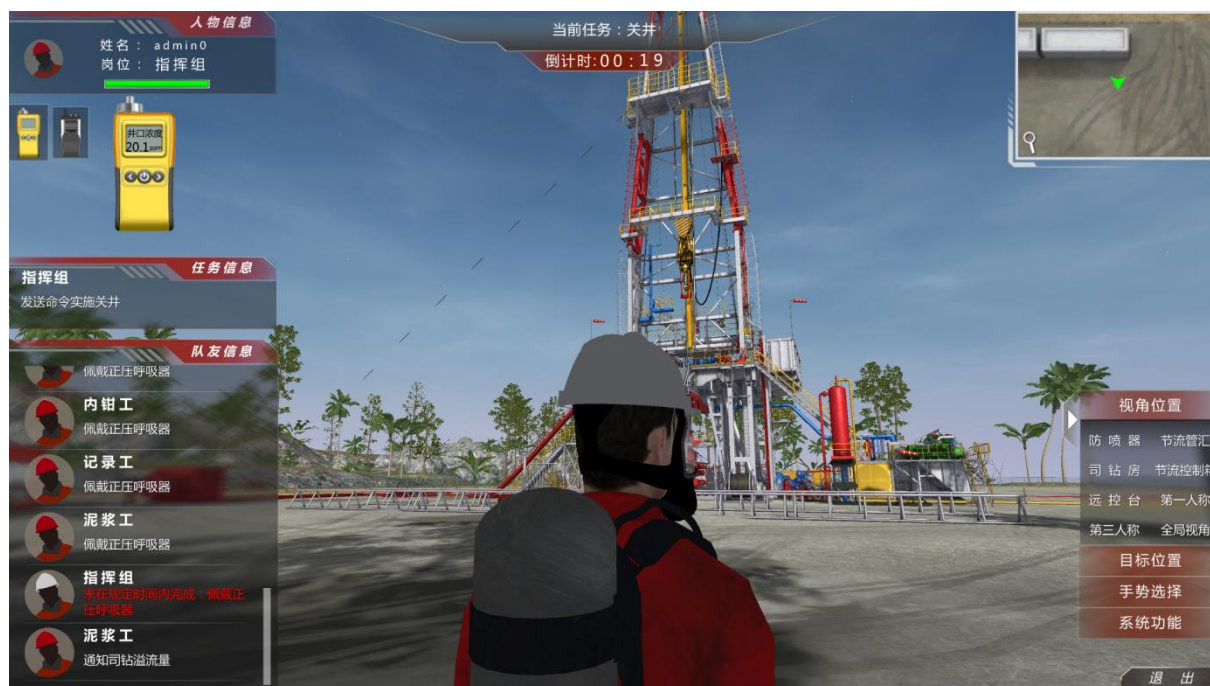


Figure 4 Student-side emergency exercise interface



Figure 5 Driller console operation interface