

A Web Portal for the Remote Monitoring of Nuclear Power Plants

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INTRODUCTION

Nuclear power plants are equipped with safety installations that should, for all practical cases, preclude the occurrence of a nuclear accident. However, additional safety measures pertaining to disaster control, and the provision of radiation protection could be required in the event of an imminent, occurring, or already terminated release of radioactive nuclides. For instance, the distribution of iodine tablets or a precautionary evacuation are included among these measures. The remote monitoring system for nuclear power plants (RM/NPP) includes the collection of radiological and meteorological variables that have an influence on the diffusion and deposition of radioactive nuclides. A central role of the monitoring system is the use of these variables in the calculation of radiation exposure values and areas. These results are used for decision support, dissemination of information, and the issuing of public warnings.

BACKGROUND

In its role as a supervisory authority for the nuclear facilities (Obrigheim, Philippsburg, & Neckarwestheim) in the Federal State of Baden-Württemberg, Germany, and for foreign facilities close to the German border (Fessenheim/France and Leibstadt/Switzerland), the Ministry of Environment in Baden-Württemberg has been operating such a remote monitoring system for nuclear power plants for almost 20 years. Recently, the system has been completely renewed using modern hardware platforms and software technologies (Hürster et al., 2005; Obrecht et al., 2002,).

As described by Hürster et al. (2005), the RM/NPP is a complex measuring and information system that records and monitors approximately 20 million data sets per day. The actual operational state of the nuclear facilities, in-

cluding their radioactive and nonradioactive emissions are automatically recorded around the clock, independently of the operator of the nuclear power plant. In addition, the RM/NPP system continuously collects meteorological data at the sites, and also receives data from external measuring networks (national and international). It provides numerous possibilities to visualize the data and to check them against threshold values and protection objectives. In the case of a radioactive leak, potentially affected areas can be determined at an early stage by a transport calculation (Schmidt et al., 2002), and protective measures can be adopted by the Ministry in cooperation with the authorities responsible for civil protection.

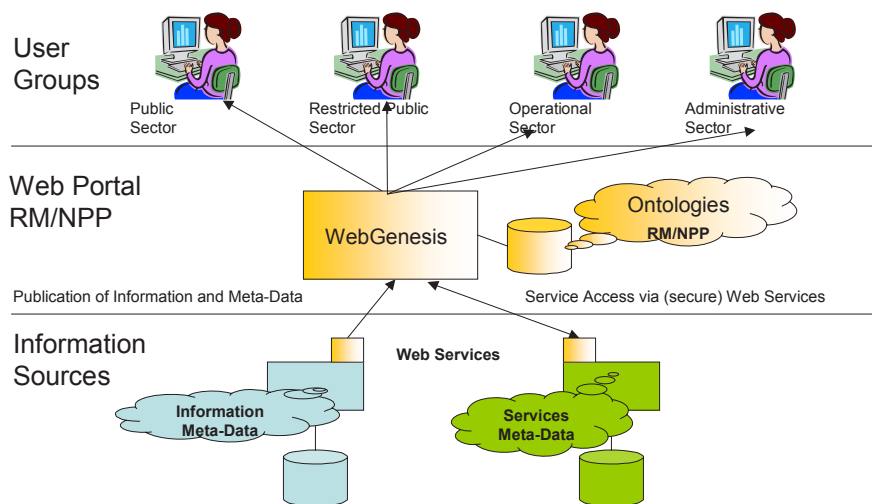
In order to allow for a broader but selective access to the information kept within the operational system, the decision was taken by the Ministry to establish a Web access function by means of a dedicated Web portal. Similar applications are envisaged by the Federal States Baden-Württemberg and Saxony-Anhalt in order to open the access to general environmental information, as imposed by legislation (Schlachter et al., 2006).

REQUIREMENTS AND BASIC CONCEPTS

It is obvious that various user groups and stakeholders have their specific needs and emphasize different aspects of the system. The following user groups can be identified and categorized (see Figure 1):

- Administrative sector
- Operational sector
- Restricted public sector
- Public sector

Figure 1. Basic concept, overview, and structure



The administrative sector covers the system administration, maintenance of configuration lists, adaptation and optimization of the system itself and of the related work flows.

The operational sector deals with the main task of the system, that is, the surveillance and monitoring functions, display of the current and prognostic situation, risk assessment, and decision support.

The restricted public sector will provide the necessary information for the crisis squad, for public services (the staff of rescue forces and fire brigades, etc.), and all other authorities responsible for civil protection. This may contain confidential information or security-related orders that are not foreseen for the public disclosure, for example, in order to avoid panic reactions and pillage.

Finally, the public sector will serve as an information platform for the general public, giving an overview about the current radiological situation, exposure risks, and the development of these risks. The public sector will also provide general and specific recommendations in case of an imminent dangerous situation.

The large extent and the complexity of the available information combined with the various views of the diverse user groups call for specific selection and preparation of the data for display in graphical and/or tabular form depending on the user group. This is the core point for the design and implementation of the Web portal: to provide for each user group, a specific set of Web pages that contain all the information that is needed to achieve the assigned tasks in the best possible way.

By analyzing the existing functionalities and the customer needs, a set of requirements has been derived. The main aspects are:

- Harmonization and matching of the heterogeneous sets of information
- Electronic situation display, including animation features
- Simplification of the user interface
- Modern display capabilities, especially for graphical representations
- Possibility to combine various representations
- Easy-to-use approach by offering well-structured information
- Definition of user groups by means of hierarchical access privileges
- Well-targeted preparation of the presentations (“generated by experts, to be viewed by anybody”)
- Automated, timely publication of (selected) information and metadata
- Publication of reports via secure Web services (e.g., in alarm situations)
- Implementation of an “intelligent” public warning system
- Improvement of the emergency management capabilities, by introducing workflow tools and corresponding templates
- High-quality standards with respect to safety, security, and system availability—even under emergency conditions

A first approach is to derive the coarse structure of the Web portal (see Land Baden-Württemberg, 2004) from the structure of the various user groups, as indicated and illustrated in Figure 1. Moreover, it is highly recommendable to adapt the basic concept of different access privileges, which has been successfully applied in the existing operational

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