Chapter 26
Information Technology and the Development of a Global Safety Culture:
A Nuclear Perspective

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ABSTRACT

A nuclear power plant is one of the most complex sociotechnical systems ever created, with operation requiring multiple organizations, extensive interaction, and a mission to protect public health and safety. A strong global nuclear power safety culture is important, with over 400 nuclear power plants worldwide and more under construction to reduce fossil fuel dependency. We increasingly rely on technology, stressing our need for energy independence, security, reliability, education, and safety. Lessons learned from nuclear power safety culture development have a large potential audience. Unfortunately, the complexity of nuclear power and restricted access to operational data have limited outside research on and understanding of nuclear power safety culture. This chapter provides a conceptual, methodological, empirical, and operational perspective on the development of commercial nuclear power safety culture, focusing on the role of information technology (IT) in building, maintaining, and expanding global nuclear power safety culture.

INTRODUCTION

This chapter focuses on nuclear power safety culture (also referred to as safety culture or nuclear safety culture), formally defined in 1991 as "that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance" (International Nuclear Safety Advisory Group, 2002, p. 1).

Nuclear power plants are unfamiliar to most people, and it is suggested that the following three points may be helpful with respect to nuclear power safety culture.

1. Nuclear power safety culture is specific to the commercial nuclear power industry for

production of commercially available electrical power, and is integral to all levels of an organization: management, operations, maintenance, technical, and administrative staff, instructors, etc. Nuclear power safety culture as described herein is not applicable to nuclear weapons development or policies, the "Obama initiative," nuclear waste storage, uranium mining and processing, medical applications of radioactive isotopes, or other nuclear issues. Development, characteristics, and status of safety culture in other nuclear contexts is quite different from that of commercial nuclear power, and is outside the scope of this chapter.

2.   Nuclear IT systems and applications are power plant, department, and/or work-group specific by necessity, and cannot be addressed by any single system, architecture, or technology. There is a need to focus on flexible, highly customizable and reliable IT solutions that can be adapted to specific cultures, technology, and needs. Learning about effective nuclear power principles and solutions (human and technological) can help to strengthen safety culture in other high-risk industries.

3.   Since the terrorist attacks in the United States (U.S.) on September 11, 2001, publicly available information on commercial nuclear power plants has been severely restricted to address concerns about terrorist attacks on nuclear power plants, applying to technological and behavioral data. Available nuclear power references and examples are limited. In some cases, similar examples from other industries or research contexts have been provided to address this issue.

We tend to view cultural awareness, safety culture, and complex technology as very recent phenomena, yet development of nuclear power safety culture began in the 1940s. Compared to other high-reliability, high-risk industries, such as

chemical processing, aviation, or rail transport, commercial nuclear power has a strong safety record, and extremely high expectations for safety and information sharing. Unfortunately, most people are unaware of the scope of nuclear power safety culture development efforts, the extensive emphasis that nuclear power places on adapting to advanced technology and multiple cultures, or the intrinsic role that IT plays in this process.

IT has helped us address the objectives of nuclear power safety locally and nationally. Since the Three Mile Island nuclear power plant accident in 1979, IT has helped us develop and expand a global nuclear power safety culture. IT supports a wide range of critical information functions, such as: accurate data collection, organization, and retrieval; communication across all levels of an organization, emergency response networks, and national or international industry alliances; enhancing training and simulation; enabling complex risk assessment; and supporting scheduling, operational, and maintenance activities.

Research on IT and culture is increasingly focused on safety, including environmental, industrial, security, and public health issues, emphasizing the need for global, culturally sensitive perspectives. Empirical research and nuclear power plant operating experience have shown that national, regional, and local culture can substantially impact nuclear power plant worker performance and attitude, that cultural differences can be operationally and functionally significant to developing and maintaining safety, and that technology substantially determines structure and social integration of an organization (Rochlin & von Meier, 1994). A strong correlation between a positive safety attitude and low accident rates has been demonstrated (U.S. Nuclear Regulatory Commission, 2002). The importance of addressing cultural issues through enhanced IT applications is increasingly being recognized worldwide, as shown by the increased interest in culturally-aware technology and the need for increased cultural sensitivity in our business and social interactions.

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