



THE ROLE OF OCCUPATIONAL HEALTH PSYCHOLOGY IN NUCLEAR POWER PLANTS: APPROPRIATE PLACEMENT FOR SUITABLE JOBS

Selçuk ŞEN
İstanbul Arel Üniversitesi, Lisansüstü Eğitim Enstitüsü

NÜKLEER SANTRALLERDE İŞ SAĞLIĞI PSİKOLOJİSİNİN ROLÜ: UYGUN İŞE UYGUN PERSONEL

ABSTRACT

The role of nuclear energy in meeting today's energy needs is increasingly prominent. In this context, nuclear power plants have specific challenges in terms of occupational health and safety. This article addresses how personnel selection and placement in nuclear power plants is carried out within the framework of occupational health psychology. The research begins by defining the fundamental components of occupational health psychology and touches upon the unique psychological challenges encountered in the nuclear sector. A comprehensive profile of the ideal nuclear power plant worker, encompassing mental, physical, and emotional aspects, is presented. An in-depth examination has been conducted on the role of psychometric tests and interviews in the personnel selection process. Particularly, when addressing the adaptation processes of new employees to the plant environment, the pivotal role of occupational health psychology becomes evident. In the conclusion, the article emphasizes the strategic importance of placing the right person in the right job and highlights the contributions provided by occupational health psychology in this area, drawing attention to potential recommendations for the sector.

Key Words: Nuclear Power Plants, Occupational Health Psychology, Personnel Selection, Adaptation and Integration.

ÖZET

Günümüzde enerji ihtiyacının karşılanmasında nükleer enerjinin rolü giderek artmaktadır. Bu kapsamda, nükleer santrallerin iş sağlığı ve güvenliği konusunda kendine has zorlukları mevcuttur. Bu makale, nükleer santrallerdeki personel seçimi ve yerleştirmenin, iş sağlığı psikolojisi perspektifinde nasıl ele alındığına dair detayları sunmaktadır. İlk olarak iş sağlığı psikolojisinin temel unsurlarını tanımlayarak başlanmış ve nükleer sektördeki özgün psikolojik zorluklara değinilmiştir. İdeal bir nükleer santral çalışanının zihinsel, fiziksel ve duygusal yönleri üzerinden geniş bir profil sunulmuştur. Personel seçim sürecinde psikometrik testlerin ve mülakatların önemi derinlemesine incelenmiştir. Yeni katılan çalışanların santral ortamına adaptasyon süreçleri göz önüne alındığında, iş sağlığı psikolojisinin kritik rolü vurgulanmıştır. Sonuç kısmında, doğru personelin doğru pozisyonda yer almasının stratejik değeri altı çizilmiş ve iş sağlığı psikolojisinin bu bağlamdaki katkılarına, sektör için önerilerle birlikte dikkat çekilmiştir.

Anahtar Kelimeler: Nükleer Enerji Santralleri, İş Sağlığı Psikolojisi, Personel Seçimi, Uyum ve Bütünleşme.

1. Introduction

Nuclear power plants emerge as one of the most crucial components of contemporary energy production. However, the safe and efficient operation of these facilities is not solely dependent on technical and engineering prowess. The mental and psychological health of the employees plays a pivotal role in this equation. Personnel working in this field must excel not only in technical knowledge but also in psychological resilience and stress management capabilities. In this context, the role of occupational health psychology becomes vital to ensure the right individuals are placed in appropriate roles and assist them in

maintaining their mental and emotional robustness. This study aims to delve deeply into the significance of occupational health psychology in nuclear power plants, focusing on personnel selection, training, and support mechanisms.

1.1. The Importance of Nuclear Energy and the Rising Demand in the Sector

Nuclear energy occupies a vital position in energy production. Since the mid-20th century, nuclear energy has been at the forefront of energy generation due to its sustainability and efficiency advantages (World Nuclear Association [WNA], 2020). The primary advantages of nuclear energy are:

*Corresponding author: Psikolog Selçuk ŞEN, İş Sağlığı Psikolojisi, psk.selcuksen@gmail.com, ORCID: 0000-0001-7731-8234.

6 NOT: Bu çalışmada sunulan tüm görüş ve düşünceler yazarına aittir; yazarın bağlı olduğu kurumu hiçbir şekilde yansıtmamaktadır; bunlar kurumun resmi görüşünü temsil etmemekte olup, resmi bir görüş olarak kullanılamaz ve bu şekilde değerlendirilemez.

- a. Low Carbon Emission: The process of nuclear energy production has limited carbon emissions, playing a critical role in combating global warming and climate change (Intergovernmental Panel on Climate Change [IPCC], 2018).
- b. High Energy Density: Nuclear fuels provide a higher amount of energy per volume compared to other energy sources (WNA, 2020).
- c. Energy Security: The role of nuclear energy in national energy profiles can reduce dependency on energy imports (International Atomic Energy Agency [IAEA], 2020).
- d. Long-lived Fuel Resources: Known uranium reserves ensure the prolonged fulfillment of energy needs (IAEA, 2020).
- e. Economic Factors: Although the costs of construction and commissioning are high, nuclear power plants offer economic energy production in the long run (Ferguson, 2011).

However, nuclear energy production also faces various challenges. Accidents, radioactive waste management, and the risk of nuclear weapons proliferation are significant concerns that need attention in this sector (WNA, 2020).

1.2. Specific Challenges in the Nuclear Sector Regarding Occupational Health and Safety

Nuclear energy, while advantageous in energy production, is also associated with specific challenges and risks. The use of radioactive materials brings forth the risk of radiation exposure to workers. Such exposure can lead to both acute and long-term health complications (International Atomic Energy Agency [IAEA], 2019). Additionally, ensuring the safe storage of waste generated during nuclear energy production is paramount. This process demands the application of special protocols for the long-term and safe storage of radioactive wastes (National Research Council [NRC], 2012). It's imperative to remember that swift and effective intervention is crucial in any accident or emergency scenario at nuclear power plants (Nuclear Energy Agency [NEA], 2014). Workers in this sector may constantly be under stress, being cognizant of potential hazards (Slovic, 1987). The complexity of technological equipment used in nuclear power plants necessitates workers to have a high level of technical knowledge and skill. This demands continual training and staying updated (WNA, 2020). Lastly, nuclear facilities are vulnerable not just to workplace accidents and radiation dangers but also to potential terrorist acts. Hence, along with physical security measures, implementing cyber security measures is also of great significance (IAEA, 2011)..

1.3. Importance of Occupational Health Psychology in This Sector

The nuclear energy sector confronts many challenges that impact the psychological well-being of its workers, with occupational health psychology playing a pivotal role in this arena (Cox et al., 2000). One of the primary

challenges faced by workers in the nuclear energy sector is managing the stress induced by radiation and potential accidents. Awareness of such dangers can engender high levels of stress among employees (NEA, 2022). Occupational health psychology aids workers in effectively developing strategies to cope with this stress. This not only enhances their overall well-being but also optimizes job performance (Quick et al., 1992). The intricate nature of nuclear energy production mandates coordinated team efforts. Psychological training fosters effective communication among team members and facilitates understanding intra-team dynamics, contributing to the prevention of potential mishaps (Salas et al., 2015). Especially in emergencies, the ability to make quick and informed decisions is fundamental. Occupational health psychology can assist workers in this sector to hone their decision-making abilities (Klein, 2008). Factors such as extended working hours and persistently being at risk can adversely affect the mental health of the workers. Occupational health psychology ensures early identification and efficient management of such mental health issues (Sauter et al., 1990). Finally, continuous learning and adaptation are paramount in the nuclear energy sector. Occupational health psychology supports this perpetual change and growth process, contributing to enhancing workers' adaptability and learning capacities (Barling & Frone, 2004).

2. What is Occupational Health Psychology?

Occupational health psychology (OHP) is defined as an interdisciplinary science at the intersection of psychology with occupational health and safety (Leka & Jain, 2010). The field focuses on strategies to protect and enhance the health and well-being of workers by examining both physical and psychological aspects of the work environment (Schonfeld & Chang, 2017). OHP particularly centers on key issues such as the reduction of job-related stress (Quick et al., 2013), achieving a balance between work and personal life (Greenhaus & Allen, 2011), ergonomic workplace design (Hendrick & Kleiner, 2001), understanding organizational culture and climate (Zohar, 2010), enhancing employee skills and knowledge (Salas et al., 2012), and managing job-related psychosocial risks (Cox, Leka, & Ivanov, 2005). This approach has the potential to enhance the overall productivity and well-being of both individuals and organizations (Leka, Cox, & Zwetsloot, 2008).

2.1. Definition of Occupational Health Psychology and its Core Components

Occupational health psychology examines the effects of physical, psychological, and social challenges encountered in the workplace on employees' health, well-being, and performance (Leka & Jain, 2010). Professionals in this field conduct studies from a multidisciplinary perspective on how workplace conditions impact individuals' physical and mental

health (Schonfeld & Chang, 2017). The core components of the discipline include:

- a. **Stress and Burnout:** Focuses on the causes, effects, and coping methods related to workplace stress (Quick et al., 2013).
- b. **Work-Life Balance:** Investigates the interactions between work and personal life and their effects on employees' well-being (Greenhaus & Allen, 2011).
- c. **Ergonomics and Physical Health:** Evaluates the effects of workplace design and organization on employees' physical health (Hendrick & Kleiner, 2001).
- d. **Organizational Culture and Climate:** Explores the effects of the workplace's social and cultural dynamics on employees (Zohar, 2010).
- e. **Training and Capacity Building:** Assesses training and development programs to enhance employees' professional skills and knowledge (Salas et al., 2012).
- f. **Psychosocial Risk Factors:** Involves the identification, evaluation, and management of psychosocial risks in the workplace (Cox et al., 2005).

Occupational health psychology provides scientific approaches and strategies for organizations and individuals to cope more effectively with the challenges posed by working life (Leka, Cox, & Zwetsloot, 2008).

2.2. Unique Psychological Challenges Faced by Workers in the Nuclear Sector

Employees in the nuclear energy sector face unique psychological challenges due to the nature of the industry and its high security demands (Edwards et al., 2019). The devastating consequences of nuclear accidents (e.g., Fukushima and Chernobyl) can instill a perpetual fear of accidents in workers, while continual radiation exposure can cause health-related concerns (Anderson & Brown, 2013; Williams, 2011). Particularly, those in critical roles carry a profound sense of responsibility, knowing that potential errors can have serious repercussions (Mitchell, 2017). Additionally, the remote and isolated locations of some facilities may induce feelings of social isolation and lack of support in workers (Harigane et al., 2021). Continual safety training and protocols necessitate that workers remain constantly vigilant (Rogers & Smith, 2016), and societal perceptions about nuclear energy can lead to the stigmatization of those working in this sector (Davis, 2019). All these challenges can negatively impact the mental and physical health of nuclear sector employees, highlighting the importance of specialized support and interventions in the industry (Carter & Lee, 2018).

3. Personnel Selection in Nuclear Power Plants

Personnel selection in nuclear power plants represents a detailed and specific process. Individuals expected to work in these energy facilities should not only

possess technical knowledge and skills (International Atomic Energy Agency [IAEA], 2019) but also be psychologically apt to work in a high-pressure and potentially hazardous environment (World Nuclear Association [WNA], 2019). The selection process relies on pertinent technical knowledge and training requirements (IAEA, 2016), the ability to manage stress with the awareness of potential workplace hazards (Kemeny, 1982), previous experience in a similar environment (NEA_OECD, 2012), compatibility within a team and teamwork (Salas et al., 2008), the commitment to strict security protocols (IAEA, 2002), certain physical aptitudes (Nuclear Regulatory Commission, 2013), and a general suitability and safety mindset (WNA, 2023).

3.1. Ideal Personnel Profile: Mental, Physical, and Emotional Requirements

Personnel working in nuclear power plants must meet specific mental, physical, and emotional criteria. Primarily, these individuals must possess technical knowledge to understand the intricate nature of nuclear energy (WNA, 2023). Alongside this knowledge, quick and effective problem-solving in unexpected situations (NEA_OECD, 2012), critical thinking (Slovic, 1987), and particularly, high concentration abilities in critical tasks are imperative (IAEA, 2019).

Physically, these workers need to have endurance for long working hours and demanding activities (Nuclear Regulatory Commission, 2015). Possessing motor skills required when working with sensitive equipment and maintaining good general health in an environment where they can be exposed to radioactive material is vital (WNA, 2023; IAEA, 2017).

Emotionally, employees in nuclear plants must possess the ability to make correct decisions under high pressure (Quick et al., 2013). Working in such an environment without effective communication and coordination within a team is challenging (Salas et al., 2008). Moreover, rapidly adapting to ever-changing conditions and unexpected events (Zohar, 2010) and always acting with safety as a top priority (IAEA, 2002) are crucial for personnel in this industry.

The ideal personnel profile in a nuclear plant is shaped by these mental, physical, and emotional requirements. Additionally, an employee's willingness for continual education, staying updated with industry developments, and contributing to professional growth are of utmost importance (WNA, 2020).

3.2. Importance of Psychometric Tests, Interviews, and Selection Processes

The personnel selection process in nuclear power plants is crucial. When performed incorrectly, it could lead not only to economic losses but also to severe safety risks. Psychometric tests play a vital role in objectively evaluating individuals' abilities,

personalities, and other psychological traits (Gatewood, Feild & Barrick, 2010; Schmidt & Hunter, 1998). The interview process is a critical tool for understanding a candidate's motivation to work in the nuclear sector (Huffcutt & Arthur, 1994) and to determine whether a candidate has the technical knowledge required for a specific position (Campion et al., 1994). The overall selection process plays a critical role in determining the right candidate, aiming to minimize potential safety risks and increase overall organizational efficiency and effectiveness (Ryan & Ployhart, 2014).

3.3. Specific Requirements for Positions in Nuclear Plants

Nuclear power plants are technical facilities with intricate operations, and individuals working in specific positions must have specific skills, knowledge, and capabilities. For example, a reactor operator should have technical education, knowledge about nuclear physics (Nuclear Regulatory Commission, 2018), and the capability to understand the operations of a reactor, with mastering emergency protocols being indispensable (IAEA, 2002). Radiation protection technicians should have knowledge about the effects of radiation (Health Physics Society [HPS], 2016) and the transportation and storage of radioactive material (World Nuclear Association [WNA], 2018). Nuclear engineers should possess in-depth knowledge on subjects like nuclear energy (American Nuclear Society [ANS], 2015) and reactor design (NEA_OECD, 2012). Security personnel should have knowledge of security protocols (International Atomic Energy Agency [IAEA], 2019) and physical fitness (Nuclear Regulatory Commission, 2022). Maintenance and repair technicians should have the ability to repair nuclear facility equipment (WNA, 2020) and the capability to work in compliance with safety standards (IAEA, 2002). Human resources and training specialists should have the capacity to identify training needs (ANS, 2016) and understand the specific requirements of the nuclear sector (Nuclear Regulatory Commission, 2019). Lastly, managers and directors should have knowledge and experience in strategic planning, budgeting, and matters related to nuclear energy (IAEA, 2019; WNA, 2023).

4. Employee Placement and Orientation Process

Following personnel selection in nuclear power plants, the placement and orientation process is a critical phase to ensure employees swiftly adapt to organizational culture, workflows, and safety protocols (Bauer et al., 2007). During the placement phase, it's essential that employees are assigned to positions suitable for their skills, knowledge, and capabilities (Cascio, 2015) and that the dynamics of the team they'll be joining are evaluated (Kozlowski & Ilgen, 2006). The orientation process introduces corporate culture, vision, and mission (Van Maanen & Schein, 1979), provides job-specific technical training (Goldstein & Ford, 2002), educates about safety protocols and

radiation protection methods (IAEA, 2002), assigns experienced personnel for guidance (Allen, Eby & Lentz, 2006), and assesses the adaptation process (Aguinis & Kraiger, 2009). Managing this process effectively ensures personnel in nuclear plants perform their duties efficiently both technically and organizationally.

4.1. Suitability Criteria for Various Positions

Nuclear power plant positions are known to entail technical, specific, and high-risk tasks (WNA, 2020). With this feature, there are certain suitability criteria for each position (IAEA, 2015). For instance, a reactor operator should have an education in nuclear technology or engineering, possess relevant certificates, and have specific experience (WNA, 2023). A radiation protection technician must have radiation protection training and certification, experience working with radioactive materials, and undergo regular health checks (Nuclear Regulatory Commission, 2022). Nuclear engineers need a nuclear engineering degree, relevant engineering certificates or licenses (WNA, 2019). Security personnel must have undergone security training, possess first-aid and CPR certificates, and be physically robust (IAEA, 2019). Maintenance and repair technicians must have electrical, mechanical, or relevant technical training and certifications, have experience on nuclear facility equipment, and have tool-using abilities (WNA, 2020).

4.2. Orientation and Mentorship for New Personnel

Within nuclear power plants, rapid assimilation of organizational culture, workflows, safety protocols, and team dynamics for new employees is paramount (Bauer & Erdogan, 2011). Orientation programs for these newcomers offer insights into the overall institutional operation and its values, a process whose efficacy has been highlighted in research (Klein & Weaver, 2000). Providing task-specific training is vital for the newcomer to effectively fulfill their role (Goldstein & Ford, 2002). The introduction to team dynamics plays a pivotal role in fostering collaboration and effective communication (Salas et al., 2015). Mentorship notably aids in the quick assimilation of an employee into their role (Allen et al., 2008). Feedback from the mentor becomes a critical factor in enhancing employee performance (Eby et al., 2008). During this process, one-on-one sessions between the mentor and mentee allow for effective addressing of concerns and challenges (Noe, 1988).

4.3. Contributions of Occupational Health Psychology in Placement and Adaptation Processes

Occupational health psychology examines the physical, mental, and emotional well-being of individuals in relation to work, playing a critical role in the placement and adaptation processes of new hires. Stress induced by entering a new job environment

can be managed as defined by occupational health psychology (Quick et al., 1992). Psychological principles promote more effective communication and collaboration between newcomers and existing team members (Salas, Cooke, & Rosen, 2008). Given that occupational health psychology encompasses in-depth knowledge of how individuals learn most effectively, it assists organizations in delivering training to new hires most efficiently (Kraiger et al., 1993). Mentorship, in this context, is pivotal as psychological principles can guide the enhancement and optimization of the mentor-mentee relationship (Eby et al., 2008). Ultimately, occupational health psychology holds the potential to amplify individuals' job satisfaction and commitment (Judge et al., 2001).

5. Conclusion

Nuclear power plants, characterized by their complexity and necessitating profound technical knowledge, skills, and safety awareness, require their personnel to undergo rigorous training and preparation, both technically and psychologically. This study has encompassed various factors from ideal personnel profiles in nuclear positions, selection processes, to placement and adaptation processes. Emphasis has been given on how occupational health psychology plays a pivotal role, from protecting personnel from potential hazards like radiation, to managing stress, and fostering team dynamics. In conclusion, technical know-how, psychological resilience, stress management skills, and adaptability to team dynamics are all imperative in the nuclear energy sector. Occupational health psychology, by offering scientific approaches and strategies, contributes to making the industry safer, more effective, and efficient.

5.1. The Critical Importance of Placing the Right Personnel in Appropriate Jobs in Nuclear Plants

Nuclear power plants are high-risk industrial environments known for their complex and critical operations (WNA, 2020). In this context, the concept of placing the right person in the right job is especially crucial in nuclear energy production. In nuclear plants, even minor mistakes can have serious repercussions, hence hiring appropriately trained and skilled personnel can minimize these risks (IAEA, 2018). Achieving maximum efficiency in nuclear energy production is vital for both economic considerations and consistent energy supply; hence employees possessing the correct skillset can contribute to the smooth operations of the plants (NEA_OECD, 2012). Cost-effectively, placing an employee wrongly or employing one without the requisite skills can lead to mistakes, potentially inflating costs (Pfeffer & Veiga, 1999). Moreover, employees placed in the right roles can have better career development opportunities, potentially boosting their job satisfaction and commitment (Arthur, Khapova, & Wilderom, 2005).

5.2. Contributions and Benefits of Occupational Health Psychology in this Process

Occupational health psychology aims to protect and enhance the physical, mental, and emotional well-being of employees. The expertise in this field plays a pivotal role, especially in high-risk and complex work environments like nuclear power plants, in the effective placement and adaptation processes. Occupational health psychology can assist in enhancing stress management skills for employees (Lazarus & Folkman, 1984), elevate commitment and motivation towards the job (Meyer & Allen, 1991), and provide insights into team dynamics and intra-team communication (Salas, Sims, & Burke, 2005). Additionally, it offers guidance on individual career development and effective organizational learning strategies (London, 1983) and provides strategies to enhance leadership capabilities and emotional intelligence (Goleman, 1995).

5.3. Recommendations and Expectations for the Future

Occupational health and safety within nuclear power plants is in a continuous evolution, shaped by technological advancements, updated regulations, and evolving safety protocols. In this context, integrating new technologies into occupational safety practices can enhance job productivity while minimizing radiation exposure risks. Investing in continuous training programs and psychological support mechanisms to enhance employees' cultural and mental awareness is fundamental. In a globalized world, emphasizing cross-cultural interaction and training is crucial for nuclear power plants where individuals from diverse cultural backgrounds collaborate. Moreover, a proactive approach should be adopted to prevent potential accidents and risks. Overall, the expectation in the nuclear energy sector is the creation of a safer, more sustainable environment with occupational health psychology playing a more central role. This vision reflects the ever-changing nature of both the sector and occupational health psychology and their interdependent relationship.

Türkiye's foray into the nuclear energy sector to meet its energy demands and enhance energy security is of paramount importance in terms of occupational health and safety. The mental and physical health of personnel working in this domain directly correlates with occupational health psychology. In this regard, Türkiye requires customized training programs tailored to its geopolitical position, climate, and socio-cultural dynamics. These programs would assist employees in enhancing their awareness in stress management, effective crisis response, and balancing work-life. Additionally, Türkiye's recent positioning in the sector necessitates ongoing research and development on psychosocial risk factors, working conditions, and stress coping strategies. International collaboration plays a significant role, offering opportunities for knowledge and experience exchange. The continuous

evolution of technology used in nuclear power plants emphasizes the importance of employees' psychological adaptation. Public perception of nuclear energy can influence the psychological well-being of plant employees, underscoring the need for informative campaigns. Finally, ensuring nuclear energy projects align with sustainable development goals amplifies occupational health psychology's potential to augment public welfare.

In conclusion, the growth of Türkiye's nuclear energy sector accentuates the significance of occupational health psychology. Recommendations such as tailored training programs, continuous research and development, international cooperation, and technological adaptation can augment the psychological well-being and overall job safety of sector employees. This is crucial not only for the sustainability of energy production but also for Türkiye's broader developmental goals.

6. References

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