

Chemical Process Safety at a Pyroprocess Facility

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1. Introduction

Management of spent fuels stored in nuclear power plant sites in South Korea is one of the most significant issues because of the limited capacity for available areas in South Korea. A pyroprocess, called a dry process compared to a wet process, is regarded as a fascinating technology to recycle the valuable materials and to reduce the volume of wastes. In Korea Atomic Energy Research Institute (KAERI), we have been developing each unit process for a pyroprocess in the PyRoProcess Integrated inactive DEMonstraion (PRIDE) facility as an engineering-scale inactive test as well as lab-scale facility [1].

In a pyroprocess, there are several types of chemical and electro-chemical processes with various operational conditions. Thus, different hazard factors are distributed all over the process lines, containing not only radiological materials but also chemical and toxic materials. For example, there are molten-salts of LiCl and LiCl-KCl at above 500°C, cadmium for a liquid electrode, inert argon gas in a hot-cell, and chlorine gas for an UCl₃ production, etc.

Chemical Process Safety at Fuel Cycle Facilities, NUREG-1601, was published to provide broad guidance on chemical safety issues relevant to fuel cycle facilities in 1997 [2]. This explains the role of chemical process safety, basic information needed to properly evaluate a chemical process safety, and appropriate methods to identify and evaluate the chemical hazards and assessing the adequacy of the chemical safety. In this study, chemical safety in pyroprocess is to be discussed based on the NUREG-1601.

2. Discussion

A definition of the hazardous chemicals is substances which are toxic, corrosive, flammable, explosive, or reactive. And they can cause a significant detrimental effect to the public, worker, co-worker, or environment. Although, in addition,

some substances are not hazardous under a normal operational condition, they may cause a harmful situation under an extreme condition or in a circumstance with other materials. Thus, all hazards and their characteristics in a facility should be thoroughly examined and addressed. It can be divided into three types of the hazards related to the chemical hazards:

- a. Chemical risk cause by inherent chemical properties, which affect occupational health or the environment;
- b. Chemical risk produced by a radioactive material; and
- c. Plant conditions such as fire or explosion (caused by chemical materials) which affect the safety of radioactive materials;

Interestingly, NRC does not regulate chemicals, but verifies interactions between chemicals and NRC-licensed nuclear materials and equipment. Those interactions may mislead to loss of a licensed material, degradation of equipment, and loss of containment or confinement.

Considerations to establish a methodology on the chemical safety in terms of chemical information, chemical safety evaluation, and assessment would be discussed for the purpose of chemical safety in a pyroprocess facility.

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REFERENCES

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