Fabrication and Installation of Platform type Balance for Nuclear Material Accountability in Hot Cell

Jeong-Hwan Jeong, Jong-Sook Hong, Ho-Dong Kim, Hee-Sung Shin
Korea Atomic Energy Research Institute, 1045 Daedeokdaero, Yuseoung, Daejeon, Korea
jwjeong@kaeri.re.kr

1. Introduction

A reliable weighing balance is required to accurately measure the nuclear material in bulk form of spent fuel in Advanced spent fuel Conditioning Process (ACP). Because of operation in the isolated hot cell ACP needs to be controllable remotely and to have a more stringent operation conditions compared to the existing fresh fuel handling process. (see Fig.1) Likewise, safeguards technology currently available has to be also reinforced in the areas of accountability system, measurement system, and containment and surveillance system. Although a bulk weighing balance, as one of the means of special nuclear material accountability, is presently being used the measurement outcome has been very unstable mainly due to large error propagation. This new bulk weighing system has been developed focusing on operational convenience, accuracy, and reliability of the balance. (see Fig.2) Indicator display in the balance is designed in such way to display the date conveniently and to make it easily maneuverable. The load cell equipped in the weighing platform was chosen to be water proof, not affected by weight distribution on the platform. The Platform is protected from corrosive salts by covering up with SUS316 series. The balance is interfaced with a PC through radiation resistant cable and sharing weighing signals in both sides simultaneously.

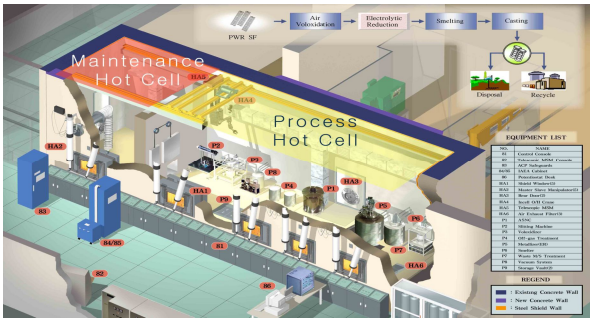

Fig.1 ACP hot cell

2. Development and Results

2.1 Indicator Display Mechanism

The indicator display gives a digital weighing value which can be read off directly from balance with built-in illuminating LED lighting to help it visibility in a dark environment. The balance is interfaced with PC through RS-232C port to communicate mutually in data sharing for proper records and management. With the help of separate software the raw data is analyzed and stored to get each weighing value integration. Load cell voltage in the weighing platform is adjusted remotely to calibrate zero point and minimum and maximum load limit. On a selective basis balance scale unit can be changed as necessary.

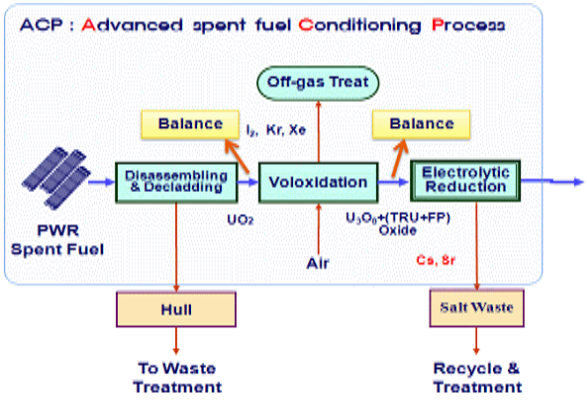

Fig.2 The application of balance in the ACP

2.2 Development and Manufacture of Weighing Platform

The weighing platform is deployed in the hot cell in such way that repairing and maintenance work on the balance can be handled with a manipulator jig above the covering of the weighing platform can be removed, reinstalled, and replaced with a new one and minimization in size of weighing system allows maximum utilization of hot cell operational space. Weighing platform covering and frame were made of SUS16 series to prevent them from discoloring and corrosion. A maximum weight of 200 kg can be weighted without a significant error from the average weight burden. A weighing container was equipped with 4 wheels to move around easily even with weighing process material mainly consisted of special nuclear material. The connector, FFA type LEMO connector, for signal cable was specially chosen to make it possible work with the manipulator. The connection cable between weighing platform and signal indicator extended to 15 meters was introduced through 20 mm hot cell penetration. In consideration of maximum weight burden of manipulator 3 standard weights were selected as each of 5 kg and used for calibration. (Fig.3) As a result of calibration the

balance was verified as operating within the error specified, ± 40 g Calibration standards were certified by the National Standard Institute.

Fig.3 shows an example of the test of and display

3. Conclusions

Under the IAEA Integrated Safeguards System officially enforced as of June 2008, the implementation of ACPF safeguards leads to establish nuclear material accountability mainly consisted of nuclear material measurement activity and C/S monitoring. Of the nuclear material accountability one major activity is to weigh out the quantity of process material especially if it is in bulk form and chemically and physically in a homogeneous condition. In order to obtain accurate weighing data the introduced balance needs to be reliable with regards to precision and acceptable to IAEA verification. This weighing system sufficiently satisfied the above mentioned criteria. Furthermore, indicator and applicable software can lead to a data treatment system which can accommodate multiple port signals including NDA signal for improved accounting data production from various MBA.