TRANSURANIC WASTE EXAMINATION QUALITY ASSURANCE AT THE IDAHO NATIONAL ENGINEERING LABORATORY[a]

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ABSTRACT

Since 1954, defense-generated transuranic (TRU) waste has been received at the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL). A major objective of the Department of Energy (DOE) Nuclear Waste Management Programs is the proper management of the defense-generated TRU waste. The Stored Waste Examination Pilot Plant (SWEPP) is providing nondestructive examination and assay of retreivably stored contact handled TRU waste in order to certify it to the Waste Isolation Pilot Plant Waste Acceptance Criteria (WIPP-WAC).

SWEPP's capabilities for certifying contact handled waste containers include weighing, real-time radiographic examination, fissile material assay examination, container integrity examination, radiological surveys and labeling of waste containers. These processes involve not only instrument accuracy but also a wide range of technician interpretation from moderate on the assay to 100% on the radiograph. This, therefore, requires a variety of quality assurance techniques to ensure that the examinations and certifications are being performed correctly.

The purpose of this paper is to discuss the methods utilized by SWEPP for checking on the examination process and to ensure that waste certifications are being properly performed. Included is the application of the quality assurance techniques to each examination system, the management of the data generated by the examination, and the verification's to ensure accurate certification.

INTRODUCTION

Transuranic waste to be placed in the Waste Isolation Pilot Plant (WIPP) must be certified as meeting the Waste Acceptance Criteria (WAC) established. SWEPP performs this certification for transuranic waste stored at the INEL. The assurance that this certification is being performed accurately is vital to the proper disposal of this waste. Therefore, a variety of quality assurance techniques are used at SWEPP to ensure both equipment and personnel performance during waste examination. After briefly describing the examination process, we will discuss the quality control measures taken, in particular, how they relate to personnel performance.

The Swepp Mission

Starting in 1970, the defense generated TRU waste sent to the INEL Radioactive Waste Management Complex (RWMC) has been stored in a retrievable manner consisting of placing the waste containers on an asphalt pad and then covering with plastic, plywood and earth. The Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico is being build to receive TRU waste for placement in a mined salt bed repository. Certain acceptance criteria has been established for the waste that will be received by WIPP. Since WIPP is a demonstration project, some of the criteria are directed at being able to remove the waste from WIPP after the initial five years of operation in the event that this method of disposal is shown to be unacceptable.

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SWEPP's non-destructive examination capabilities enables verification that a waste container and its contents comply with the WIPP waste acceptance criteria. It also allows those containers whose radioactive content falls below those for TRU waste, to be identified as Low Level Waste (LLW). These containers can therefore be disposed of as LLW. Other containers which are within the bounds of TRU waste limits but do not meet the WIPP-WAC are designated for either the Process Experimental Pilot Plant (PREPP) at the INEL or a special case classification. This group may become processable at PREPP once they gain operational experience. Otherwise, these containers will be handled by future facilities.

The retrievably stored TRU waste at the INEL is approximately 58,000 cubic meters. This is made up of some 120,000 drums and over 10,000 boxes. These drums for the most part are 55 gallon and while the boxes vary in size, a majority are 4 x 4 x 7 foot on a side. They are also constructed from a variety of materials. Therefore, SWEPP must be capable of examining several types of waste containers. Based upon the operational life of WIPP and other considerations, the examination of this waste, plus the waste which is produced at PREPP, must be accomplished in a timely manner. This results in several thousand containers per year being examined by SWEPP.

The SWEPP examination process is, in reality, a quality control function which verifies compliance of the waste to the requirements for placement in WIPP.

Description of Swepp

The four principal elements of the examination process at SWEPP are the weighing of the waste container, ultrasonic inspection of the container, fissile material assay and radiographing of the waste.

Container weight determination is a relatively straight forward activity which is accomplished at the start of the examination. Also, the available information on the container in the database is retrieved on the computer, certain elements verified and that portion pertinent to the examination process is transferred to the SWEPP Data Management System.

Compliance with the majority of the acceptance criteria is indicated by the radiograph system. This examination relies exclusively of the operator's judgement, their decisions on the waste and its container determines if the waste is certifiable to those criteria items that can only be established by radiograph.

The fissile material assay is performed on a Los Alamos National Laboratory developed system. It uses a combined passive and active neutron approach. The waste container is placed in the device whose operation is controlled by a computer. Assay results are provided to the operator and sent to the Data Management System.

The Container Integrity system was developed by the INEL and automatically makes ultrasonic container thickness measurements utilizing eight transducers. It also is computer operated and prints out the location of invalid data or below the limit metal thicknesses. The operator then verifies the locations either visually or with a handheld transducer.

Acceptance Criteria

While it is not the intent of this paper to discuss quality assurance measures performed against each criteria elements, it is beneficial to consider four elements which are typical of those that each step of the process verifies and discuss the quality techniques used for these elements.

Criteria A - Contact-handled TRU waste packages or package assemblies shall weigh no more than 25,000 pounds

Criteria B - The fissile or fissionable isotope content for contact-handled TRU waste containers shall be no greater than ... 200 grams per 55 gallon drum ... in PU-239 fissile gram equivalents...

Criteria C - Waste containers shall have a design life of at least 20 years from the date of certification.

Criteria D - Transuranic waste shall not be in free-liquid form. Minor liquid residues remaining in well drained bottles, cans and other containers are acceptable.

In addition, to criteria specific to the waste and its containers, WIPP requires certain data elements to be provided at time of shipment. This data package and an auditable record of how the data was generated forms the basis for the certification.

Examination Process Quality Control

The above description of SWEPP provides insight to the variety of examination processes which must have quality assurance techniques applied to them. A broad range of activities, from the straight forward operation of the weight scale, to the more difficult personnel judgements made at the radiograph station must be addressed. Conventional quality assurance techniques such as measurements, visual examination, etc. can not be relied on exclusively. The quality assurance program is defined in the SWEPP Operating and Maintenance Manual. Discussion of the procedures and methods used to ensure that the personnel and equipment meet or exceed requirements listed in the quality assurance plan is presented below. The discussion will utilize the previously identified criteria to illustrate the approach.

Criteria A specifies a maximum container weight of 25,000 pounds. Certification to this is accomplished by a electronic platform scale. Quality inspector verification of the scale startup procedure is performed each day. An initial calibration check of the scale is accomplished by placing the SWEPP certified weight drum on the scales, checking its tamper seal and verifying the readout on a daily basis. The inspector also reviews the weight station log daily. Annual calibration of the scales is performed by the INEL Calibration Laboratory and is traceable to the National Bureau of Standards. This is a straight forward quality assurance technique with which most of us are familiar and is used widely throughout industry.

The upper limits on the amount of fissile or fissionable material contained in the container is specified by criteria B. This determination is made by the assay device. Again the quality inspector daily verifies that the startup procedure is followed. Performance of the system is checked at the start of each day by assaying the SWEPP known source drum. Decay of the sources is taken into account. A second check is made using the SWEPP background drum to verify that external sources are not affecting the readings. The assay results provided by the device are evaluated by the operator to ensure that they are within the specified bounds. Verification of the tamper seals on these drums is also performed. Additionally, 10% of the container assays are reviewed to ensure accurate transmission of the information into the SWEPP Data Management System. Again, this is a approach commonly used and is checking the performance of the equipment.

Certification of the containers design life, as specified is Criteria C, is accomplished on the Container Integrity System (CI). Again, the quality inspector verifies compliance with the startup procedure. A system performance check is done by examining the CI calibration drum. Metal thickness measurements on this drum must be within the established range.

The nature of ultrasonic inspection methods and the exterior condition of the containers do not permit the system to obtain valid data at all locations it checks. Therefore, the computerized control system identifies to the operator the areas on the container where it was unable to show a valid data point. The operator must then examine the waste package to determine if there is an acceptable reason for the equipment not to provide a reading of wall thickness. Any feature that prevents the transducer from developing a couple with the metal capable of transmitting the ultrasonic signal results in an invalid data point. Examples are paper lables on the container in the subject area.

Other causes for invalid data are dents, DOT inprinted lables and weld seams. The reason is entered into the computer by the operator. If there is no apparent cause, a hand held transducer is used to measure the metal thickness. This transducer is calibrated before each use with a step wedge.

Proper operation of the system and the decisions being made by the operator are checked by the quality inspector who on a 10% basis observes the technician's and equipment's performance throughout the day. Verification that the container has passed the container integrity examination is performed by the Data Management System which only identifies a container as certified if it passed the integrity examination. Greater operator involvement is required on this station than the two previously discussed, therefore, we now see quality assurance of personnel performance being performed.

Demonstration of compliance to requirements such as those contained in Criteria D presents the biggest challenge to SWEPP and its quality assurance program. The output of the Real Time Radiography (RTR) system is a video image which must be interpreted by the operator. Presence of residual liquid is detected on the RTR by the operator observing a image density change with a flat horizontal line on top and the creation of wave motion or slushing when the container is moved back and forth. This must then be coupled with an estimation of liquid amount to verify that it is minor liquid residue.

Therefore, unlike the previous described processes, while we have equipment performance, it must be joined with personnel ability to make a valid judgement in order to show compliance at the RTR station. Application of quality assurance techniques must be of various types.

First let's discuss the verification of the equipment which is relatively straight forward. Again, the quality inspector observes the startup procedure performance. A part of this is the video test pattern which ensures correct operation of the television system.

Assurance of accurate operator judgements is accomplished by utilizing four main techniques. First the guidelines provided to the operator must be as clear and concise as possible. Minor residual liquid is defined in the procedures as being less than one volume percent of the container in which the liquid is contained. A table is provided as an aid which lists various shapes and their volumes based on overall dimensions. Use of this information with the known magnification of the system helps the operator determine container and liquid volumes. The procedure is checked out on the system for correctness and usability. It is then reviewed and approved by various organizations before being implemented.

However, regardless of how well written our procedures and guidelines are, judgement by the operator is critical. Therefore, extensive training is performed. The SWEPP Training Program Manual defines the program which provides to operations personnel the training and qualification/certification. Job related training is provided to all personnel required to work at the facility. Detailed requirements on each examination process for examination technicians and supervisors are specified. The program objective is to ensure that employees are properly trained to perform their assignments in a manner that meets applicable guidelines, procedures and standards efficiently and safely. It enables them to maintain operational proficiency through continual retraining and familiarization sessions. The training described below is indicative of the method used on each process.

The training starts with presentation of the reason behind the criteria and how that basis was developed so that the operator understands the function of our certification effort. These presentations are made by the people who are responsible for the INEL Contact Handled Stored Transuranic Waste Certification Program and who maintain cognizance of the WIPP criteria. This is followed by having the operator examine on the RTR mocked up drums with various known volumes and shapes of liquid. The drums contain items which are not acceptable as well as various containers with liquid. Both rigid containers such as bottles and plastic bags which simulate irregular shaped pockets in sludge wastes are used. Each container is identified, and a sheet is filled out by the operator identifing those that contain liquid and the amount of liquid contained. Their results are reviewed with them by either the quality inspector and/or examination supervisor.

When proficiency has been developed, testing is performed. First a written test of the criteria, the reasons behind it, and their knowledge of the procedure, is administered. The operator then performs an examination of a mockup drum and their performance graded by the examination supervisor and quality inspector.

Finally an overview of the RTR operation is performed by the quality inspector and examination supervisor. The inspector monitors twenty percent or more of the RTR examinations, either by observing the operator examining the containers, or by reviewing the video tapes. Additionally and independently the examination supervisor performs the same type of overview on ten percent of the containers.

The basic control of the data is the computerized Data Management System. Access to the system is by password. Data is transmitted to the system by each station. A check is made by the examination supervisor on the entire certification process, who then reviews the data, verifies completeness of the data and signs the certification statement. The data is then sent to the INEL mainframe computer located in the EG&G Computer Science Center in Idaho Falls. Access to this data is strictly controlled in order that its integity is ensured.

The final verification is accomplished by the sampling program. This involves physically opening a certain percentage of the WIPP certified containers and examining them to verify correct certification. One out of nine drums were examined in 1986 with one hundred percent compliance indicated. The 1987 sampling rate has been established at one out of every one hundred drums.

CONCLUSION

The nature of the SWEPP examination process requires that a variety of quality assurance practices be used in order to ensure accurate certification of stored transuranic waste to the WIPP acceptance criteria. Personnel judgements must be evaluated. Equipment performance has to be verified. Procedural compliance is monitored. The quality assurance measures taken with the Real Time Radiography system are not all considered to be the normal quality assurance techniques. Often we are working with a physical product on which measurements can be taken and performance testing performed. However, in this instance methods to ensure personnel performance must

be utilized. These include establishing clear objectives, performance training and providing feedback to the people. It is this type of quality assurance that is critical to SWEPP because the certification of waste will only be as good as the people performing the certification.

REFERENCES

1. U.S. Department of Energy, TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant, WIPP-DOE-069, Revision 2, September 1985.