"RETROFIT OF RADWASTE SOLIDIFICATION SYSTEMS IN SPAIN"

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ABSTRACT

In order to meet current Spanish engineering criteria as well as to provide for likely future Spanish Regulatory requirements, utilities committed to a major policy change in the preferred radwaste solidification media. In the early 1970's Spanish utilities, following the United States experience, purchased inexpensive solidification systems which used urea formaldehyde (UF) as the binding matrix. By the late 1970's the Spanish utilities, seeing the deterioration of the UF position and slow progress toward its improvement, unilaterally changed their binding matrix to cement.

This paper illustrates the implementation of this change at the ASCO Nuclear Plant. The problems of layout modifications, shortened delivery schedule and criteria unique for Spain are addressed within this paper. Also presented is the operating experience acquired during the pre-operational start-up of the ASCO I Radwaste System.

BACKGROUND

A general design criteria for Spanish plants has always been to provide a design licensable in the country of NSSS origin. For the generation of plants started in the early 1970's the NSSS was provided from the United States. This criteria followed through in many plant systems including the radwaste solidification system. As with many plants in the United States, these systems were initially designed and purchased using urea formaldehyde (UF) as the solidification matrix. Due to the difficulties caused by UF in these operating plants and the fact that Spanish plants must provide long term on-site storage, the Spanish Utilities changed direction and have retrofitted cement systems for the UF systems originally purchased.

SYSTEM DESIGN PARAMETERS

Since Spain does not have a national policy for final disposal of low level radwaste, designs must incorporate long term (approximately 10 years) on-site storage. To provide a safe and well run storage facility, the solidification matrix must be capable of long term stability without any adverse effects on the storage container. To this end, the design specification utilized to purchase the system established stringent process control and final matrix stability requirements to be met by the supplier. The parameters required by the ASCO purchase specification are shown in Table I.

TABLE I

ASCO SPECIFICATION CONSIDERATIONS

1. The solidified product generated from liquid wastes, resins and mixtures of resins-liquid wastes must comply with the following criteria:

Resistance:	4.0 psi minimum
Free Water:	zero (complete absence of water)
Leachability:	Ce-10% maximum; Li-1% maximum
Resistance to Compression:	Resins-300 psi, minimum Boric acid-500 psi, minimum

2. Verification and documentation of the final product properties by laboratory analysis must comply with present USNRC requirements or a USNRC approved Topical Report.

3. The solidification system must conform to possible future requirements imposed by the NRC. ASCO requires technical assistance to solve possible difficulties associated with solidified radioactive waste production for waste stream components not specifically detailed which may occur.

4. A detailed process control program and operating procedure is necessary to insure the proper solidification of all plant wastes generated.

5. Information and references, based on actual system operating experience from different United States plants will be provided to the Spanish Nuclear Energy Commission (JEN) to obtain the licensing of the system.

6. The solid products integrity must be adequate for a storage period of 10 years and subsequent transportation to the final disposal area. Accordingly, the storage conditions of the drums in the temporary storage building *must be sufficient to* maintain integrity and longevity of the solidified product.

7. Chemical compounds such as sodium hydroxide, citric acid, chromates, oils and other compounds normally associated with the solidification process cannot exceed quantities greater than 1% of the waste weight or modify the solid product properties.

8. First priority will be given to ASCO by ATCOR to insure compliance with the system delivery schedule.

Unique Spanish Project Considerations

In the retrofit to the cement radwaste solidification systems in lieu of the UF Systems in Spain, several considerations, somewhat unique to Spain, were encountered.

1. General Arrangement

The original UF Solidification system required a minimum amount of plant area for installation as compared to a cement system. In Spain, the storage facility is some distance from the power block, and an in-plant storage area was not required. As a result, the retrofit to a cement system did not have the luxury of an additional area to expand into. The installation of shield walls, cement and lime storage bins, and other generally larger process equipment required an efficient layout. Figures 1 and 2, respectively, show the original UF layout and the current cement system layout.

To complete the revision of the general arrangement, the following problems were addressed:

a. Recalculation of the Slab - The additional wall loads and process equipment required a new calculation for floor loads. To keep within limits, wall heights had to be limited to 3.5 meters.

b. Shielding - Since drums in the cement based process are not shielded, as opposed to the UF system's shielded liner design, the wall thicknesses had to be increased to maintain allowable dose limits.

c. Handling - The UF system used a bridge crane to move the shielded liners. The bridge crane was replaced with a process conveyor system. The conveyor transports the drums from the process fill aisle to the interim storage area truck loadout point for transfer to the on-site storage building using a shielded vehicle.

d. Storage - In the storage facility, another bridge crane was replaced with a crane of smaller capacity. Also, in the storage area, a TV system was installed to assist in positioning the drums. The cells in the storage area were modified to accept 200 liter (55 gallon) drums instead of the originally planned 50 cubic foot shielded liners.

2. On-Site Storage

Spain has not as yet decided on a national policy regarding the ultimate disposal of low-level radwaste. There are some that claim sea burial should be selected and others who support shallow land burial as the ultimate solution to this question. Based on this controversy, the utilities have built long term on-site storage facilities adjacent to the plants. These modular type buildings are designed for waste storage of up to 10 years. The moratorium is thought to be necessary for a firm national decision on ultimate low level disposal. The plant must provide a solidification matrix that can be handled after approximately 10 years and still be compatible with either of the two final disposal options. The matrix must also not react with the steel drum during its projected on-site storage period.

On-site waste handling is also an important consideration to the success of the system. A significant aspect of this is the movement of the solidified waste containers between the Auxiliary Building and the On-Site Storage Facility. For ASCO the use of an especially designed shielded transfer vehicle was provided by Dragados S.A. This vehicle can transport six (6) drums, the required 500 meters, to the on-site storage facility. Figure 3 details the design features incorporated within this vehicle.

3. Procurement Scope

The retrofitting of a radwaste solidification system presents unique problems. Considerations for minimized building changes is quite important and must be incorporated within the supplier's general arrangement of process and materials handling equipment and subsystems design. A unique difference in the procurement scope for the ASCO project was the close coordination required to accomplish the project. Equipment vendors, where possible, were selected based on delivery dates required and fabrication expertise available. Further, where possible, Spanish subvendors were preferable to the customer. Based on the preceding, equipment was furnished from both Spanish and United States sub-suppliers. The following details the specific scope of supply furnished within the ASCO project.

Item	Origin of Manufacture
Waste Metering Tank Assembly Skid	United States
Waste Metering and Emergency Return Pump Skid	United States
Process Valve Gallery	United States
Mixer and Flush Valve Gallery	United States
Intensive Mixer and Fill Head Assembly Skid	United States
Capper	United States
Main Control Panel	United States
Motor Control Center	United States
Cement Storage Transfer and Metering Assembly Skid	Spain
Lime Storage, Transfer and Metering Assembly Skid	Spain
Materials Handling Drum Transfer and Storage Systems	Spain
Sampling Systems	Spain

All Spanish manufactured items were provided by Dragados S.A. However, the designs and specifications were provided by ATCOR to Dragados S.A. with final design and manufacture performed by Dragados S.A. Close cooperation by Spanish architectural engineering team and ATCOR, through the design review and approval stages of the project, insured that all interface points within the system were proper. To minimize the time for approval and to insure good communications, design review meetings between the Spanish customer, Spanish and Spanish-based engineering firms and ATCOR were held in Spain. This approval review

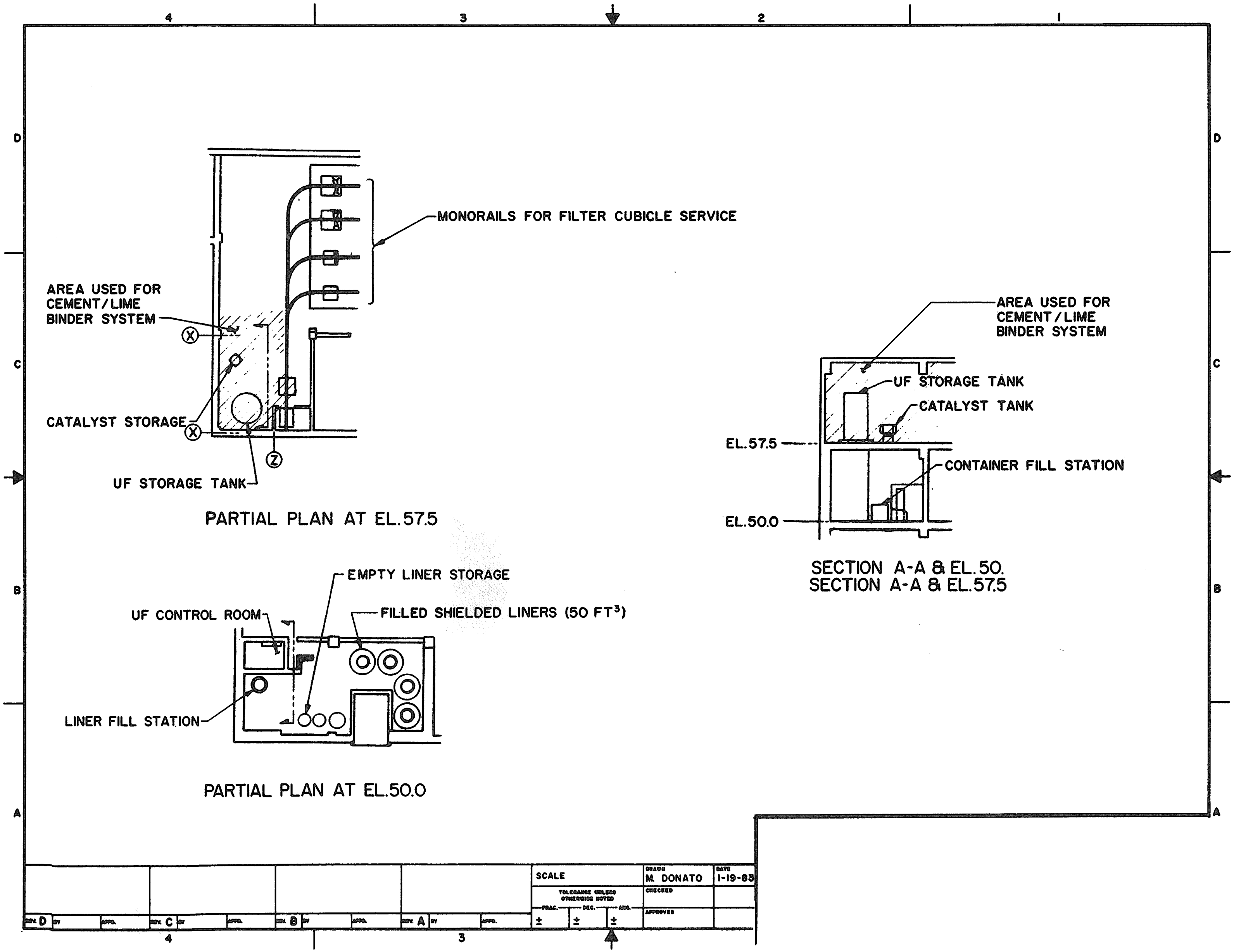

Fig. 1. Installation of UF Binder and Catalyst Storage Feed Assemblies.

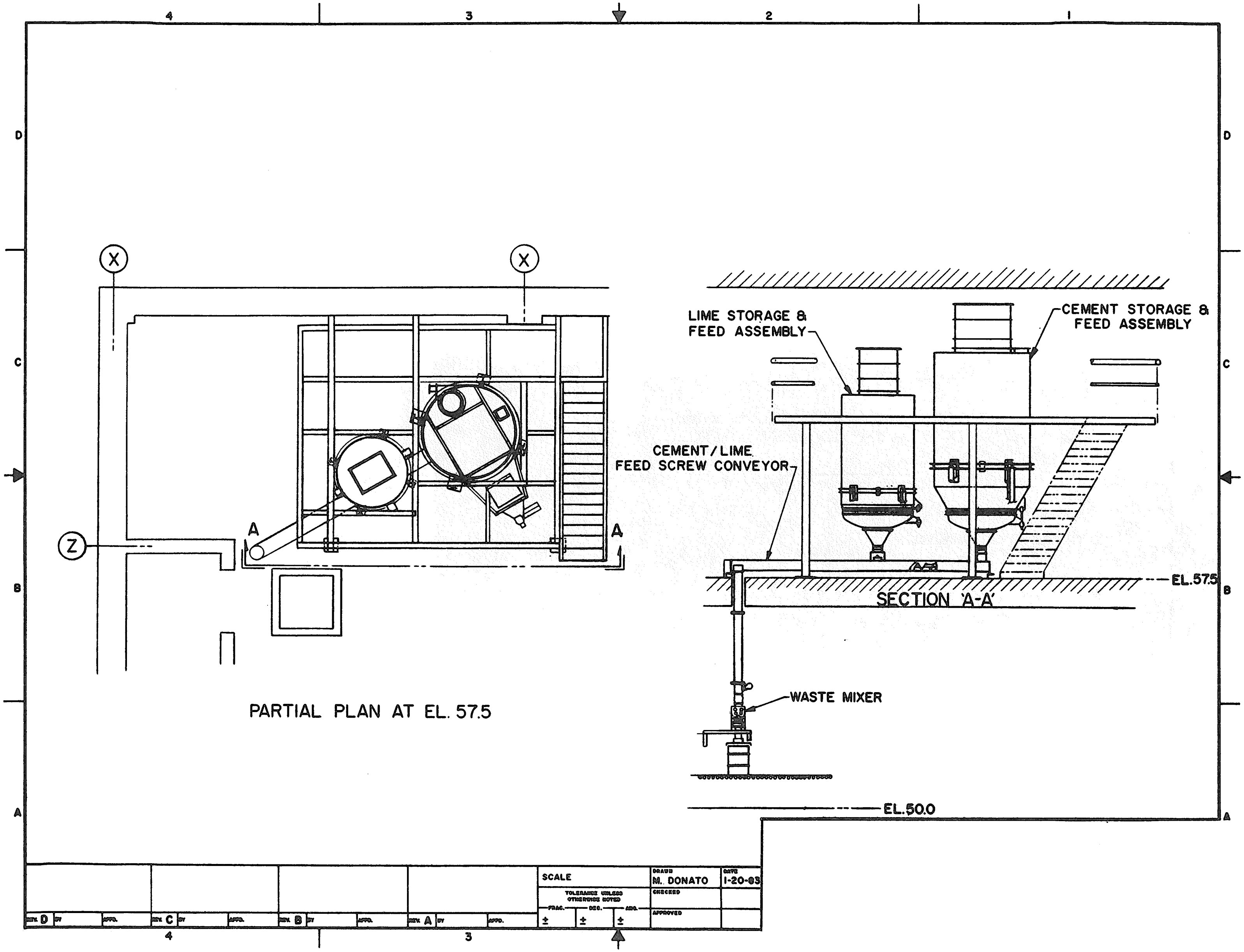

Fig. 2. Installation of Cement & Lime Binder Storage and Feed Assemblies.

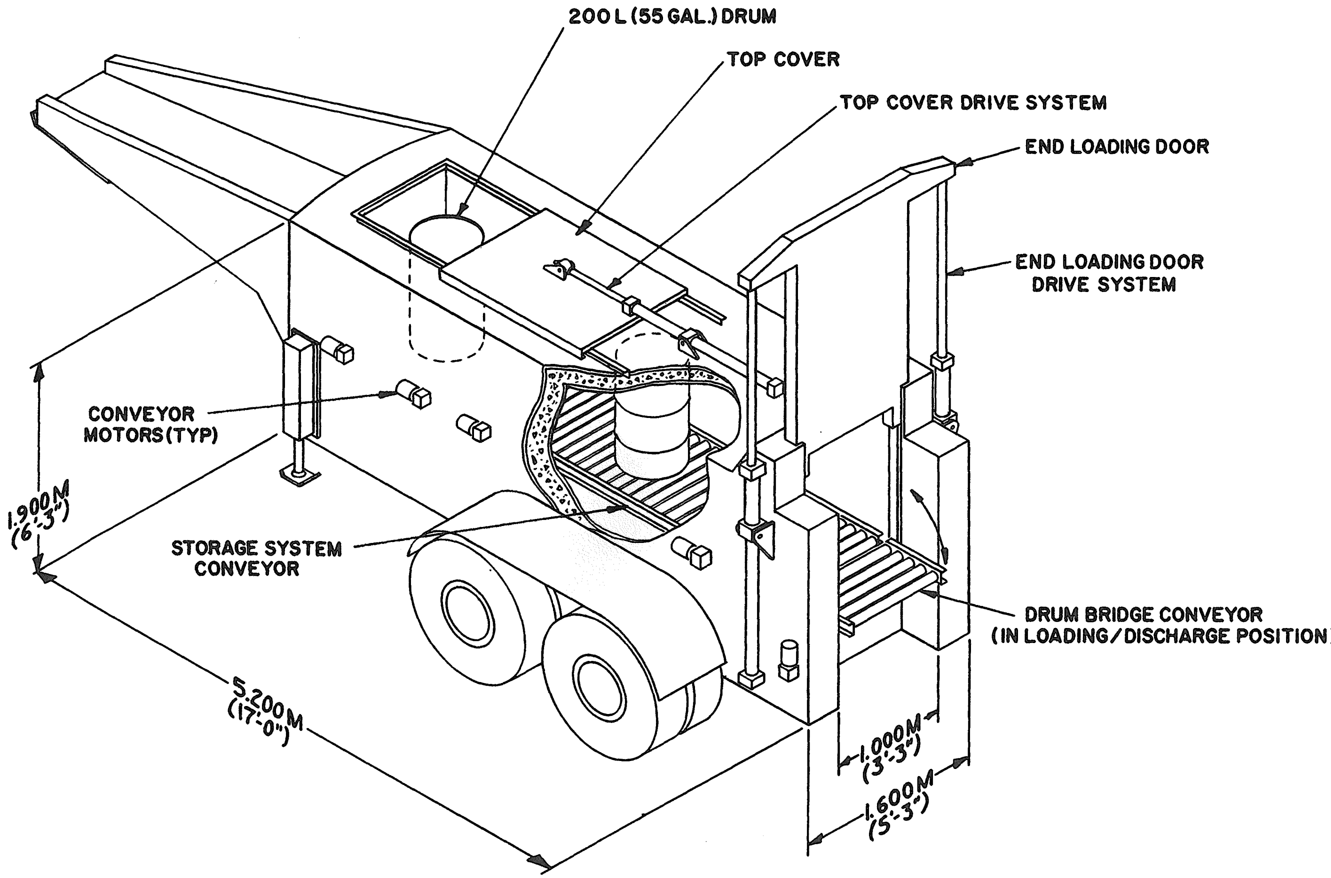

Fig. 3. Six (6) Drum Shielded Transfer Vehicle.

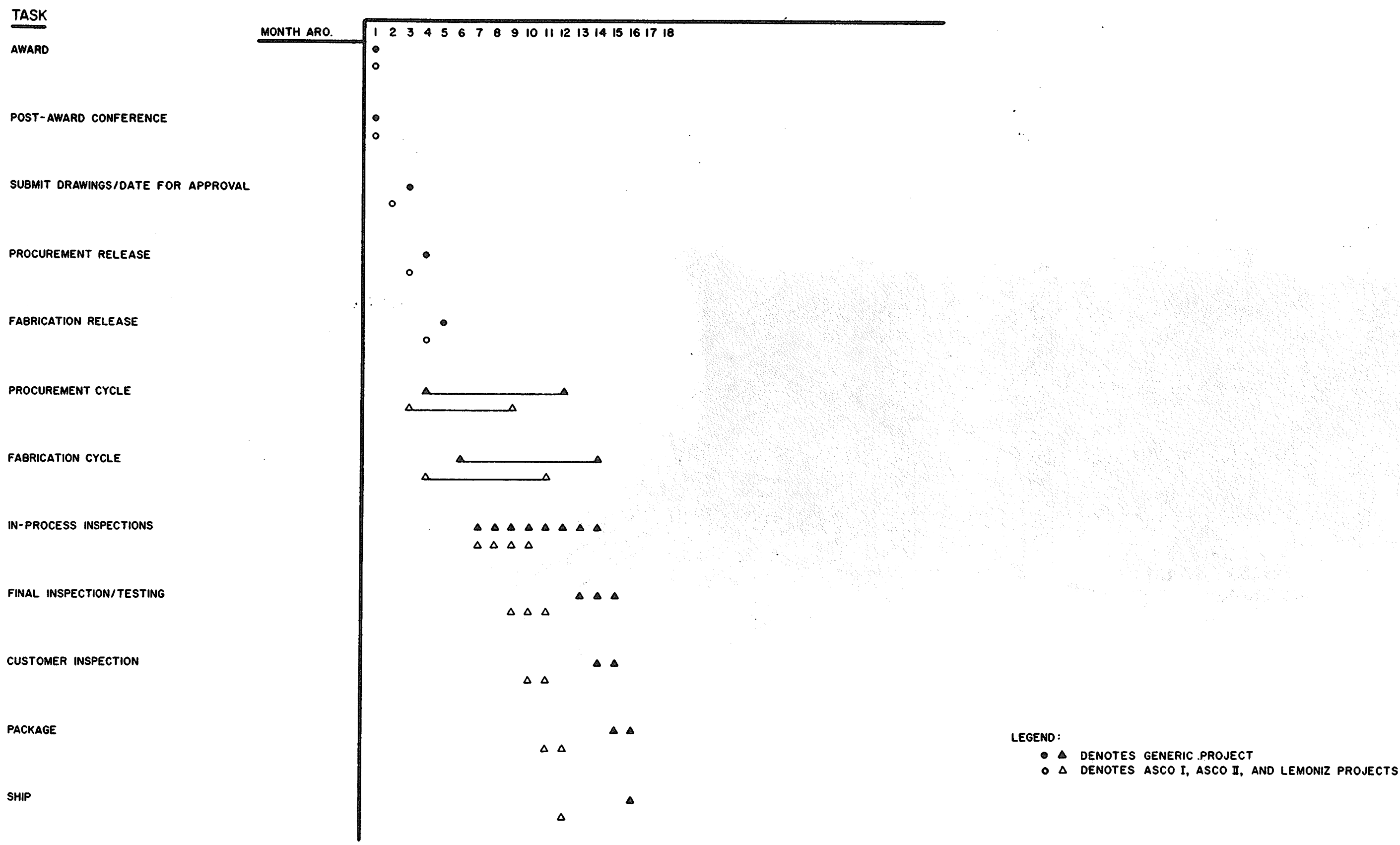

FIGURE 4

Fig. 4. Spanish vs. U.S. Generic Project Schedule Comparison for a Radwaste Solidification System.

procedure was accomplished within one (1) week as opposed to the four (4) weeks usually required for similar systems design reviewed in the United States. The proof of the viability of this approach was the successful start-up of the ASCO radwaste solidification system with minimal interface problems caused by the dual country scope of systems supply.

4. Delivery Schedule

As previously discussed, due to the system being a retrofit and the necessity of having the system completed prior to plant operation, delivery was of utmost concern to ASCO. As shown on Fig. 4, systems are normally provided within 16 months after receipt of an order (ARO). In this case, as well as other Spanish UF retrofit systems provided, ATCOR was contractually obliged to deliver systems in considerably less than the generic program schedule. Less than a twelve (12) month delivery schedule was accomplished. Unique to this project was time saved during customer review and approval phases of the project, which were performed by sending ATCOR engineering personnel to Spain. A marked up, approved for construction, set of drawings, specifications and procedures were completed in one week in lieu of the normal four weeks required. The language and cultural differences were also bridged due to a joint cooperative effort toward successful completion of the common project goal of meeting the desired schedule. Minor problems associated with the capper system delivery are of interest in that a necessary rework required during the final inspection almost caused the extension of the system delivery. However, based on weekend and continuous (24 hour) efforts by a subvendor, this item was shipped by air express to New York from Colorado in time to meet the ship sailing deadline, thus maintaining the required system delivery schedule. Other obstacles relating to commercial areas and scheduling were also solved through constant and effective expediting to insure the delivery commitments to the customer were met.

5. Start-Up Experience

As is usual with systems start-ups in the United States, the ASCO System in Spain did experience minor problems. Of the problems experienced, only one was related to the division of scope. The cement conveyor system feed rate, as defined by ATCOR to the Spanish architect engineer, was transmitted properly to the Spanish manufacturer. The manufacturer, however, supplied a screw design which was 10 times the cement feed rate necessary. Upon careful review, the error was clearly that of the manufacturer. The manufacturer, at their expense, replaced the screw, with only a slight delay in the system start-up. Other start-up problems which were dealt with by the start-up engineers directly were of significantly less concern and are detailed below.

Problem A - The cement and Lime Bin Discharge Valves tended to close during operation of the bin vibrators. To solve this problem, the valves were secured and locked in the open position during operation to preclude inadvertent closure.

Problem B - The cement feed conveyor manufacturer did not supply tachometers with the cement conveyors. Motor ammeters were supplied at a later date by the manufacturer. These ammeters give an indication of conveyor speed by relating motor load to motor speed which then made it similar to the controls originally required by the design specification.

Problem C - The Drum Transporter (Conveyor) System Vibrating Table was mounted on springs that allowed the Table to depress during drum filling which deactivated the drum connected control system. To solve this problem, supports were added to the Table structure to limit table motion during the filling operation thereby eliminating the false signals.

In all, the aforementioned problems were insignificant as witnessed by the successful system start-up in September of 1982.

6. Potential Future Changes

As with plants in the United States, Spanish utilities are investigating the use of volume reduction (VR) systems. The potential benefits of reduced on-site storage and burial site volumes required are the major considerations. To minimize the difficulties of backfitting the VR systems into the plant, a consideration to use the existing solidification system has been proposed. This requires a solidification matrix compatible with the products of the VR system. The most important product now being considered is ash from a dry active waste incinerator.

Also provided for is the use of an alternate solidification matrix such as the DOW media. As presently designed, this change would cause minimal impact on the existing waste system installed at the ASCO Plant in that only binder storage and transfer, and controls changes would be required.

Summary and Conclusion

With the supply of the reactor plants for Spain coming from the United States so too came the radwaste solidification systems. The use of UF as the solidification agent also followed U.S. practice. When operating difficulties with UF systems appeared in the United States, Spain had to made some hard decisions; abandon UF or patiently wait for solutions; if abandonment is the approach, what to replace the UF with and what impact would this have on the long term storage facility? Also the difficulties associated with this significant change in plants more than half built had to be overcome.

In Spain, the change was made to cement and the backfit of these systems in plants such as ASCO have proceeded through start-up and appear to be decisions well made.