# ROCKY FLATS CENTRALIZED SIZE REDUCTION FACILITY PROJECT UPDATE

Brian Mathis
Kaiser Hill
Rocky Flats Environmental Technology Site
Post Office Box 464
Golden, Colorado 80402
303/966-3474

Ronald Warnecke
TRUTech, L.L.C.
P.O. Box 1365
Idaho Falls, Idaho 83403
208/524-4361

Robbin Duncan
Polestar Applied Technology
16928 E. 583 PR N.E.
Benton City, Washington 99320
509/588-6312

## ABSTRACT

There are approximately 2,000 radioactively contaminated gloveboxes within the U.S. Department of Energy ( DOE) complex that either need to be, or will soon need to be, removed and prepared for disposal. These gloveboxes exist in laboratory facilities, processing facilities, shutdown/deactivated buildings, non-certified temporary waste containers, and, in some cases, radioactive landfills. Approximately half of these gloveboxes reside on the Rocky Flats Environmental Technology Site (RFETS) within buildings currently undergoing, or soon to commence, deactivation activities. In order to successfully accomplish the RFETS deactivation and decommissioning activities needed to meet the 2006 closure in a safe and cost effective manner, an alternative to the current size reduction approach and methods is required.

The Centralized Automated Modular Mobile (CAMM) system consists of three separate but integrated components: the sealed building penetration chamber (SBPC), the standard transport onsite management package (STOMP), and the centralized size reduction/waste handling structure. These components will allow the gloveboxes to be removed and transported over existing onsite roadways to a facility specifically designed for dismantlement, size reduction, and packaging of the gloveboxes. The CAMM system will reduce personnel exposure to radioactive and hazardous environments, minimize hands-on involvement by operations personnel and accelerate the overall project schedule. It is intended that, following its use at RFETS, the system would be dismantled and transported to another site within the DOE complex for redeployment.

This paper will describe each component of the CAMM system and provide a brief summary of the overall project status.

## INTRODUCTION

### Background

In recent months, there has been a continuous and increasing emphasis on closure of RFETS by the year 2006, which is a four-year acceleration of the baseline schedule. As a result, deactivation and decommissioning work in the site's buildings will be accelerated as part of the overall Rocky Flats Closure Plan (RFCP). Accelerating this work will require the deployment and utilization of innovative and state-of-the-art technologies and tools.

A major task in the cleanup effort is the disposition of gloveboxes and other transuranic (TRU) contaminated equipment, which require the size reduction and packaging of these items for shipment to a permanent waste disposal site. Progress is constrained by the limitations of current practice, which consists of operator intensive hands-on methods that are slow and expensive. A modern state-of-the-art size reduction and packaging system could expedite this work by consolidating the size reduction operations into a specifically designed and constructed facility. The system would also incorporate tools, techniques, and systems that remove personnel from an extremely hazardous work environment. This system would replace current manual size reduction operations in the facilities being deactivated and decommissioned, thus freeing up personnel and resources.

There are approximately 2,000 radioactively contaminated gloveboxes within the DOE complex that require disposition. This number may be conservative due to the different methods used by the facilities to identify the boundaries of a single glovebox. Additionally, these gloveboxes vary drastically in size, complexity, contamination loading, and radiation levels. They exist in laboratory facilities, processing facilities, shutdown or deactivated buildings, non-certified temporary waste containers and, in some cases, radioactive landfills. Most of these gloveboxes will need some type of initial characterization and size reduction prior to packaging in order to meet current disposal requirements and criteria.

## Mission

The primary mission of the CAMM project is to accelerate closure of RFETS by providing a systematic means to size reduce, package, and export the larger TRU-contaminated items and materials that reside in the roughly 770 remaining buildings at RFETS. These buildings must be demolished and removed to meet the end points and goals of the Rocky Flats 2006 Closure Project. The design, construction, and operation of the CAMM system must involve the participation of the site subject matter experts (SMEs), appropriate technical experts and vendors, the DOE, and the regulators and stakeholders. Additionally, the entire project must adhere to prescribed safety standards, and must meet cleanup requirements and directives as agreed upon by the DOE, the site contractors, stakeholders, regulators, and the community.

A secondary mission of the CAMM project is to develop a system that is generally applicable to other sites that will follow RFETS in achieving closure.

## Benefits

The CAMM project is the design, procurement, and operation of an integrated system that significantly improves the size reduction and waste packaging of radioactively contaminated gloveboxes and other items of equipment. The primary benefit of the CAMM system is the dissociation or de-coupling of the size reduction operations from the deactivation/decommissioning activities within the buildings. Size reduction activities, especially when performed manually in-situ, are time consuming and may, due to their hazardous nature and the relatively high levels of labor support required, consume all the building's personnel and resources.

Deployment of the CAMM system will expedite the ongoing deactivation and decommissioning (D&D) operations in the remaining buildings at RFETS and ultimately at other sites by reducing or eliminating the need for an in-situ size reduction and packaging operation, which is in the critical path for site closure. This will consolidate most of the repetitive operations into one central facility and free the building personnel to address the D&D issues. The system minimizes both the direct hands-on contact of the waste by operating personnel and the generation of secondary waste. This system will also facilitate positive control over the inventory of contaminated items of equipment throughout the size reduction and packaging processes.

The design philosophy for the CAMM system is that of modular construction to simplify and optimize system assembly and disassembly, and to permit shipping the components to another DOE site for redeployment after the closure of RFETS.

## PROJECT APPROACH

In early 1999, Kaiser-Hill (K-H) D&D Closure Projects at RFETS undertook a study to determine the feasibility of a project based on a centralized size reduction process and to define its technical specifications. This was consistent with their role as client user with the ultimate responsibility of managing the cleanup process. K-H perceived that many questions, concerns, and potential barriers existed from both a technical feasibility standpoint and from a RFETS deployment/operability standpoint. To address these, K-H established a project team that consisted of a group of technical consultants and the appropriate SMEs at the RFETS.

This team utilized a systematic approach to obtain the information and data necessary to evaluate the technical feasibility of the CAMM system. This approach involved two separate, but linked and dependent efforts. The first effort was to thoroughly identify and evaluate the current work practices, tools, and methods used for the size reduction of TRU-contaminated gloveboxes, tanks, and vessels. Based on current work practices, the team developed strategies for the operation of each component of the CAMM system. In addition, they identified a set of attributes to describe the broad range of factors that must be considered to determine the feasibility of this system to accomplish the project goals. Consideration of these attributes guided the team in seeking appropriate information to support a realistic evaluation of the project in terms of costs, benefits, technical maturity, and potential effects on the community and the environment. These attributes, or feasibility issues, consisted of the following:

- technical feasibility
- performance requirements
- personnel safety
- operational deployment
- environmental considerations
- estimated costs
- potential barriers

The second effort was to establish a comprehensive set of specifications, criteria and requirements that would define limits for a pre-conceptual design of this system. This information, coupled with the proposed methods of operation, was then refined by a thorough review by on-site RFETS technical experts. The resulting document was issued as a Request for Information (RFI) in mid-July 1999.

This RFI was issued to seek the participation of vendors, suppliers, and other technical experts in determining both the feasibility and the rough order-of-magnitude costs associated with the CAMM system. Nearly 50 vendors and suppliers were solicited for information. Responses were received from four vendors.

Based upon information provided by the vendors, coupled with the envisioned methods of operation, the team evaluated each major component of the CAMM system in terms of the attributes as identified above.

Individual reports issued as the result of this evaluation included a project description, a feasibility analysis, a user's requirements document, and a safety basis strategy. The evaluation confirmed that the proposed CAMM project was both technically feasible and practical.

## CAMM SYSTEM DESCRIPTION

The CAMM system consists of three separate, but integrated, components: the SBPC, the STOMP, and the centralized modular size reduction structure (CMS). The SBPC will be used to remove the materials to be size-reduced from the on-site buildings in a safe and controlled manner. The STOMP will be used to transport the radioactively contaminated items (i.e., gloveboxes, tanks, equipment, and components) from the various on-site buildings to the centralized size reduction facility. It is intended that the CMS will be located within the protected area (PA) of RFETS. Gloveboxes, tanks, vessels, piping, and other process equipment from the on-site buildings will be transported to the centralized facility for initial characterization, size reduction, and final disposition and packaging in approved waste containers. It is envisioned that methods, techniques, and tooling to be used in the size reduction facility will minimize direct hands-on contact by the operating personnel.

### Sealed Building Penetration Chamber

The SBPC provides a method to safely remove the TRU-contaminated materials from individual buildings and transfer them to the STOMP for shipment to the centralized modular mobile structure. The SBPC consists of an entryway installed through an opening in the outer wall of the building, an access chamber and an elevator that is external to the building. A separate entryway is provided at each floor of the building, as required, for removal of TRU-contaminated materials. The installation of airlocks will either use existing openings, such as large windows or double doors, or it will require the construction of new openings. The access chamber rides in the supporting framework of the elevator/lift system and it is provided with an entryway that will mate to the one installed in the building. Once mated, a seal will be formed, which will prevent any release of contamination to the outside environment. The SBPC elevator moves from the docking level of the STOMP to the upper floor levels, and it has a mechanical support system that is completely independent of the building. This avoids placing any additional loads on the building structure and ensures proper alignment with the SBPC building airlock and with the STOMP at the lower docking level.

The SBPC access chamber has an independent ventilation system but it relies on the building's ventilation system when the entryways adjacent to the building are open, or on the ventilation system of the STOMP when the outer entryway is open. This minimizes potential impacts to the building or to the STOMP ventilation systems and their respective airflow patterns.

The purpose of the STOMP is to move TRU-contaminated gloveboxes, equipment, and materials from the various buildings to the CMS. The STOMP consists of two separate components, the drive vehicle and trailer assembly and the reusable, permanently attached transport container.

The transport or drive vehicle is a commercially available transport vehicle that meets U.S. Department of Transportation (DOT) requirements and regulations. This vehicle will be modified as necessary to meet any unique on-site transportation requirements. The carrier may be equipped with outriggers to provide added stability. In addition, the carrier will be equipped with basic emergency response equipment, such as a cellular phone and a two-way radio for enhanced communication.

A reusable transport container is mounted on the transport vehicle to move gloveboxes and other TRU-contaminated materials from the various buildings to the CMS. The container will be designed to align with, and connect to, the SBPC access chamber at the docking level and also to the CMS at the materials receiving point. The container will also be designed and constructed to meet all on-site transportation and safety requirements. The construction of the transport container is described below.

The container is a custom-made box that is constructed around a steel frame, insulated, and covered inside and out with sheet metal. The unit is equipped with a high-efficiency particulate air (HEPA) filtration system, halon fire suppression, lock-downs/tie-downs for load security, an airtight rear door, and a lock and seal mechanism to prevent tampering between the origin and the destination. In addition, the STOMP container unit is constructed with a reinforced floor and a subframe that provides attachment points to the transport vehicle. The unit will be sized to accommodate gloveboxes, tanks, or other equipment up to 6 feet wide by 7 feet high and 14 feet long.

## Centralized Modular Structure

The CMS will house the initial characterization, the remote/automatic size reduction equipment, material handling, waste packaging and assay equipment and all operations and control/support systems associated with these processes. The structure will include a control room, a ventilation/filtration area, a TRU materials receipt and temporary staging area, the size reduction operations area, a waste packaging and assay area, and a temporary waste-container staging area.

The CMS is a stand-alone unit that requires only a minimum of support utilities. Specific interface requirements are established with the understanding that the CAMM system is independent from all other RFETS operations to the maximum extent possible. All components of the CMS system are designed for safety, reliability, and performance.

The CMS will be located within the PA of RFETS. The appropriate personnel responsible for the operation will determine the exact location; however, site considerations will include accessibility to existing roadways and a central location for ready access to all RFETS buildings.

Two separate locations within the centralized modular mobile structure are utilized as staging areas. The first location is to stage gloveboxes and materials that are in queue for initial characterization and/or are being prepared for introduction into the size reduction system. The second location is to stage waste containers for final assay and/or transfer to an approved on-site storage location.

The CMS structure houses the remote/automatic size reduction equipment, material handling, waste packaging and assay equipment and all operations and control/support systems associated with these processes. This includes a control room, a ventilation/filtration area, a TRU-materials receipt and initial characterization staging area, the size reduction operations area, and a waste packaging and assay area.

This facility is comprised of modular sections or modules that can be assembled at a designated RFETS location. Following completion of all size reduction activities at RFETS, this facility will be decontaminated, disassembled, and transported to another DOE site within the DOE complex that has size reduction needs. Each section or module is designed and constructed to facilitate decontamination and stabilization activities, allow preparation for shipment and transportation on federal, state and local roadways, and to support re-assembly on another site.

## Size Reduction System

The Size Reduction System is designed to remotely/automatically segment and size-reduce TRU-contaminated gloveboxes, equipment, and materials. This operation is controlled and monitored by personnel in a separate control room that is isolated from the size reduction area. The use of remote/automated equipment will eliminate personnel exposure to the high hazards and risks associated with handling contaminated materials. The design of the size reduction equipment incorporates sufficient flexibility to accommodate a wide range of metallic waste types, thickness, and configurations.

The Size Reduction System consists of material conveyance equipment, various cutting tools, and remote/robotic manipulators to deploy the cutting tools and to manipulate and handle the waste items. The system will also include a monitoring and control system that interfaces directly to a computer in the control room. The software architecture will provide both operational and administrative functions. It will provide automatic control of the conveyors and manipulators, but it will also accept interactive instructions from an operator in the control room. Keyboard entry and/or joystick movement will provide the instructions. The software will provide automated calibration routines, data acquisition and reduction, reporting and archiving, and appropriate password protection.

CMS personnel will perform an initial characterization of the glovebox or other items and load them onto the material conveyance device (place in queue) for transport to the Size Reduction System. This conveyor will start in the initial staging area, pass through an airlock door and terminate inside of the size reduction chamber.

Automated size reduction and piece handling equipment will perform all the functions associated with the segmenting of the larger items and the transfer of the waste pieces to the staged, approved waste containers. The computer data acquisition system will provide overall system control as well as individual piece tracking and will also ensure that the sized dimensions are suitable for packing in the Material Handling and Assay System.

## Material Handling and Assay System

The Material Handling and Assay System is designed for the remote handling and packaging of the size-reduced pieces. This operation is controlled and monitored by personnel in a separate control room that is isolated from the material handling area. This reduces the exposure of personnel to the high hazards and risks associated with handling contaminated materials.

The Material Handling and Assay System consists of piece handling equipment, remote/robotic manipulators, and automated packaging and assay equipment. Non-destructive assay equipment will be used to ensure proper packaging. This equipment will offer both automatic and manual assay capabilities, as required, to meet operational needs.

The system will include a monitoring and control system that interfaces to a computer in the control room. This computer will be shared with the Size Reduction System. The software will provide both operational and administrative functions. It will provide automatic control over the piece handling equipment, manipulators, and other automated equipment, but it will also accept interactive instructions from an operator in the control room. Keyboard entry and/or joystick movement will provide the instructions. The software will provide automated calibration routines, data acquisition and reduction, reporting and archiving, and appropriate password protection.

The Size Reduction System will move the cut pieces to the Waste Handling and Assay System, and deposit them onto a receiving station. Remote/robotic manipulators will then select pieces and transfer them to an approved waste container, such as a standard waste box (SWB) or a 55-gallon drum. The automated assay system will track the process and ensure that the radionuclide content within the waste container is within acceptable limits. The automated packaging equipment will then close and seal the waste container.

Once full, the waste container will be removed from the system, surveyed for external smearable contamination, and transported to the packaged waste temporary staging area. The final assay of packaged waste will be completed by a Waste Isolation Pilot Plant (WIPP) certified nuclear assay system and is not part of this project.

## APPLICATION OF THE CAMM SYSTEM AT RFETS

The deployment of the CAMM system will involve the coordination of several independent operational organizations/functions. These organizations include the deactivation and decommissioning groups within each RFETS building, the personnel who will handle, move, and transport the TRU materials from the buildings to the centralized size reduction facility, and the operations staff within the facility. Other support organizations will be involved, including industrial safety, fire safety, site engineering, criticality engineering, and representatives from various regulatory and oversight groups.

Successful operation of the CAMM system and sustained throughput performance to realize acceleration of schedules will require a coordinated and well-managed operation. Such an operation will maintain a continuous supply of TRU gloveboxes, equipment, and materials from the various on-site buildings to the centralized facility

Figure 1. graphically depicts the material flow sequence associated with the operation of the CAMM system. Additionally, the following is a brief description of the function and activities associated with each major step in the material flow sequence.

Building personnel in each of the RFETS buildings will prepare the building's gloveboxes and other items and move them through the SBPC. This will include any rough cutting and temporary sealing of these items to prevent the spread of contamination. They will then move the items through the SBPC and deliver them to the STOMP

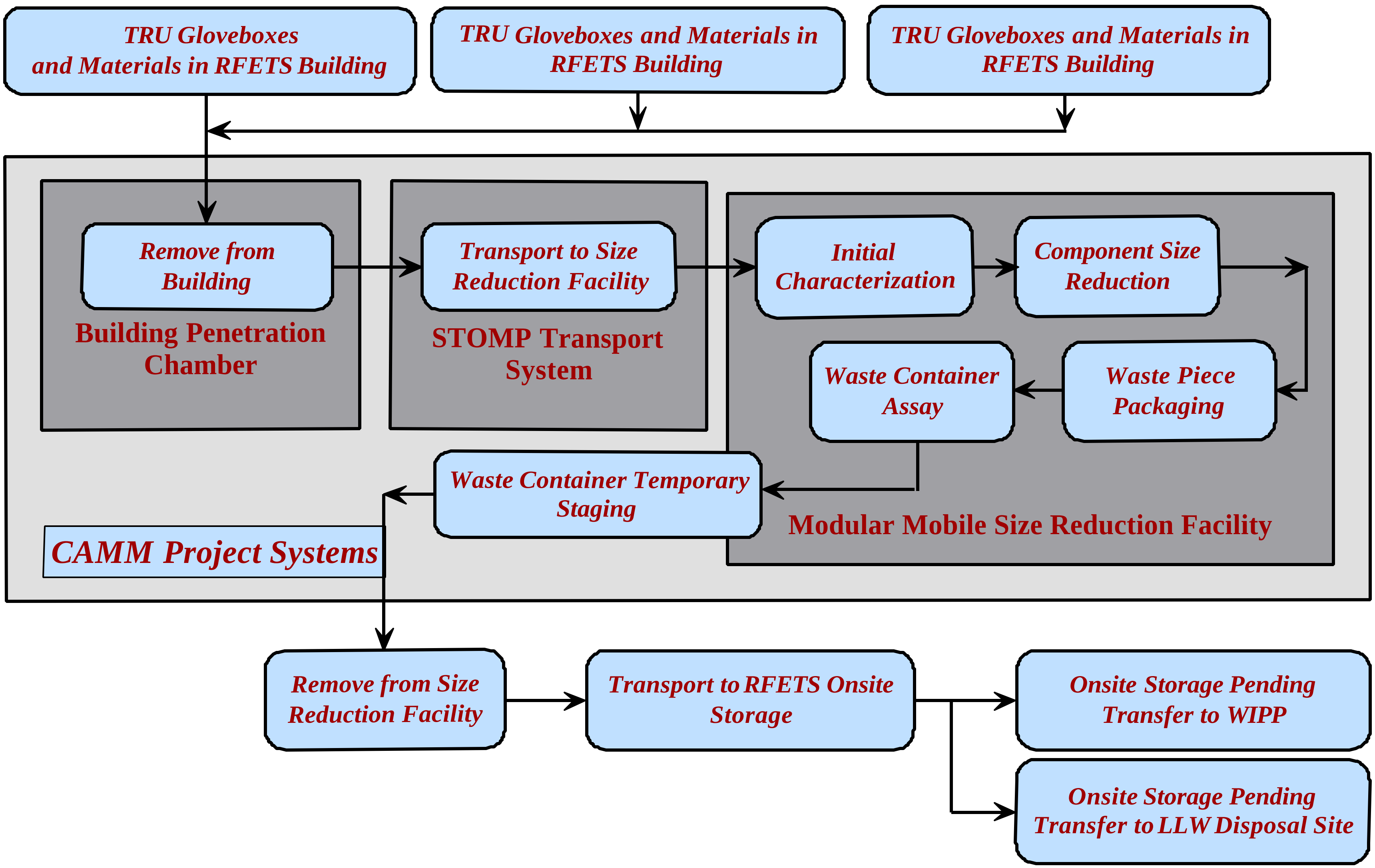
STOMP personnel will dock the STOMP vehicle at the SBPC loading facility, receive the contaminated items, and ensure that they are properly secured for transport to the CMS. They will then transport the items to the CMS and dock at the CMS unloading facility. CMS building personnel will retrieve the items through an airlock and move them to an initial staging area.

CMS personnel will perform an initial characterization of the glovebox or other components and load them onto a conveyer for transport through an access chamber to the Size Reduction System.

Automated size reduction and packaging equipment will cut the gloveboxes or other components into smaller sections and transport them through an access chamber to the Material Handling and Assay System. Automated equipment will fill the waste containers with the cut pieces, assay the waste containers and move them through an access chamber to the final staging area, pending transfer to an approved onsite location.

The containers will then be loaded onto a standard approved vehicle and transported to a RFETS onsite storage area. Ultimately, the containers will be shipped to WIPP or to a low-level waste (LLW) disposal site.

**Figure 1. Graphical Representation of CAMM Project Systems**



## COMPLEX-WIDE APPLICATIONS OF THE CAMM SYSTEM

RFETS is one of the first DOE sites scheduled for closure. Experience gained through operation of the CAMM system at RFETS will be generally applicable to the cleanup of other sites. Following closure of the RFETS project, the RFETS system can be decontaminated, dismantled, and transferred to other sites within the DOE complex that have size reduction and packaging needs. Initial design and construction of the CAMM system will incorporate modular techniques such that most of the fabrication for the system can be performed off-site at the various vendor locations with final assembly of the components at RFETS. These design and construction techniques will permit disassembly, transport, re-assembly, and reuse of the system components. Additionally, the modularity of the system will allow modifications to the components to meet the specific needs and requirements of each redeployment site.

## CONCLUSIONS

The results of this current study clearly show that there are no technical aspects of design, procurement, construction, or operation and maintenance that would preclude a successful deployment of the CAMM system at RFETS. The required technology is readily available and requires no further development.

For the SBPC and the STOMP there are no other potential barriers exist that would prevent the project from proceeding immediately forward with the conceptual design and procurement of these items. For the CMS and its associated systems, however, other potential barriers do exist. These potential barriers are associated with the uncertainty in the total cost, schedules for the time-phased delivery of material to the CMS and the ability to successfully integrate with the ongoing RFETS projects.

## PATH FORWARD

The RFETS CAMM project is proceeding forward with the conceptual design specifications of the SBPC and the STOMP. The design activities associated with the CMS has been temporarily placed on hold, pending a thorough evaluation of the integration of this portion of the system with the other projects currently underway at RFETS. This evaluation will consist of a value engineering study, supported by RFETS SMEs and various off-site technical experts and vendors. It is intended that actual procurement activities will occur as supported by the individual design efforts for each component.

Specific tasks to be commenced early next fiscal year include:

- Initiate conceptual design for the STOMP.
- Initiate conceptual design for the SBPC.
- Complete a value engineering study on the CMS. Determine the cost benefit and integration with concurrent size reduction projects to optimally support RFETS closure. This analysis would use a systems engineering approach and would focus on the following areas of design activity:

- Identify criteria and key information from the user requirements document that will be utilized in the value engineering study. Contact appropriate vendors to obtain information not received in earlier responses to the RFI.
- Develop a pre-conceptual engineering design for each component of the CMS, based on the functional user requirements identified to date.
- Complete a preliminary cost analysis.
- Develop time-phased material delivery from each facility/building.
- Determine system capacity and throughput requirements.
- Factor in lessons learned from on-going RFETS projects.
- Develop a decision tree and refine the project path forward.
- Utilize value-engineering principals to aid in evaluating the cost benefits of the CAMM system and its potential for a successful integration with other ongoing RFETS projects.