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ROBOCAL: AN AUTOMATED NONDESTRUCTIVE ASSAY SYSTEM

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Abstract

The manager of a facility handling special nuclear material (SNM) is caught in a squeeze between increased state and federal regulations and tighter funding. RoboCal uses a robot to manipulate canisters containing SNM to lower worker radiation exposure and to provide increased utilization of expensive assay equipment. In addition, it helps with accountability and material tracking. It consists of a hierarchical network of more than a dozen computers and provides a single point of contact for the user to accomplish multiple assays.

I. CURRENT OPERATIONS

Today operators manually load the calorimeters and the gamma-isotopic instruments. They receive additional radiation exposure from this handling. In addition this manual operation requires that an operator be present to reload the instrument as soon as it completes, if they are to be efficiently used. The data from the measurements is printed on paper which creates additional waste in an area where waste requires special handling.

II. FUTURE OPERATIONS

There are indications of increased federal and state regulations in the future. Funding for operations is not increasing at the same rate as the work load. In addition the use of existing funds will have more restrictions on how they are used. These problems are further complicated by the As Low As Reasonably Achievable (ALARA) policy for worker exposure.

III. ROBOTIC SOLUTION

RoboCal performs unattended assays of SNM. These assays include calorimetry using instruments developed at Mound Laboratory and gamma-isotopic measurements using a system developed at Rocky Flats. Performing assays around the clock requires no operator intervention; thus worker exposure is lowered, higher instrument utilization is achieved and the cost of providing the necessary and mandated measurements is lowered.

RoboCal is an automated nondestructive assay system that utilizes a hierarchical network of more than a dozen computers, a robot, a stacker/retriever, and seven assay instruments to accomplish its task. The computers used include the Compaq 80386-based IBM compatibles, the DEC Micro-PDP/11, and some special purpose computers that control the hardware. The main control computer handles the user interface; main-

tains a database; and directs, in a supervisory role, the actions of three worker computers. One of the worker computers controls the action of the robot and directs the actions of the equipment under its control, such as the stacker/retriever, the two barcode readers, and the force sensor. The robot moves the canisters containing nuclear material, within its workspace, providing them to the measurement instruments or to the users at the appropriate times. The stacker/retriever acts as a holding area for the canisters waiting to be assayed and for those that have already been assayed and are ready for removal. The barcode readers and the force sensor provide feedback to the robot. The assay instruments consist of two gamma-isotopic instruments and five calorimeters. The calorimeter computer, directed by the main control computer, controls the acquisition of the calorimetry measurements. The third worker computer controls the gamma-isotopic assays.

To initiate the process, two operators bring to RoboCal special canisters containing nuclear material. Information about the material is entered into the control computer and stored in the computer's database. The operators place the canister into one of three input stations and the canister is not handled by humans until it is removed from an output station. The control computer tells the robot computer to move the canister from the input station to an available holding location in the stacker/retriever. The robot computer controls the robot and its associated devices as it moves the canisters and collects information about them, such as size, weight and canister number. When one of the measurement instruments is available, the control computer tells the robot computer to move the canister from its holding location to the measurement instrument. When it has been moved, the control computer tells the instrument to perform the assay. After the assay is complete, the control computer collects the assay data and stores it in the database. The control computer then tells the robot computer to move the canister from the instrument back to a holding location. When all requested measurements have been performed, the canister is listed on an output list and made available for removal. The two operators request canisters from those given on the output list. The control computer tells the robot computer to move the selected canisters from the holding location to the output station. In addition a summary data sheet for the item in the canister is printed.

Refer questions to:

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AUTOMATED COUNTDOWN SYSTEM STATUS			11:04:59
09-10-90	INVENTORY	GAMMA ISOTOPICS	CALORIMETERS
Ready for Removal: 0 items	1 IDLE Last updated 11:01:17	1 IDLE Last updated 11:01:17	
	2 IDLE Last updated 11:01:17		
1. Operators' menu			
2. Supervisors' menu	ROBOTIC SYSTEM:		
	CIRCULAR RUBBER		
	FOR E SEMI-D		
	BAR CODE 1		
	BAR CODE 2		
	PAPER A		
	PAPER B		
	PAPER C		
		4 IDLE Last updated 11:01:17

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