N299. The Economics of Robots in Nuclear Power Plants

PSE&G (Public Service and Gas Company) conducted a pioneering effort in the application of robots at Salem and Hope Creek Nuclear plants. This effort was guided by a joint Research and Development (R&D) / Nuclear Department task force at PSE&G and concentrated on the following types of applications:

- Underwater inspection and surveillance
- Underwater cleaning
- Surface decontamination
- Remote operation and maintenance
- Steam generator secondary side tube sheet inspection, cleaning, and foreign object retrieval

As the original goals of the PSE&G effort were met, a second program has now been established. New efforts include the study and application of robots for:

- Steam generator upper support plate inspections and cleaning
- Steam generator health physics task dose reduction
- General operation and maintenance tasks
- Improved monitoring of health physics tasks
- Preprogrammed inspection of controlled radiation areas
- Service water and other plant piping inspection and repair
- Cooling tower basin sediment cleaning

Table 1. Cost Savings of PSE&G Robotics Program

Robot/Description	Costs	Estimated Savings
MiniRover MK I	$55,000	$1,200,000
MiniRover MK II	90,000	150,000
SuperScavenger (2) and related tools and equipment	120,000	300,000
Kelly Vac Decon System and associated special tools	190,000	250,000
SURBOT-T	200,000	200,000
CECIL	750,000	3,200,000
ANDROS MK VI/MISR	120,000	*
Hardware bought in support of the program: ▪ Camera/photographic equipment ▪ Special radiation probes ▪ Recording instruments ▪ Spare parts/accessories ▪ Miscellaneous special tools ▪ Robot and hardware upgrades ▪ Minor robot repairs	75,000	Not Applicable
Total	$1,600,000	$5,300,000

** The ANDROS MK VI and MISR robots were purchased late in the program (Nov. 1991). Technically, their costs should not be included in this analysis since the savings associated with these two robots would not be realized until 1992/93. However, their inclusion in the analysis is justified as a measure of conservatism in calculating program savings.*

PSE&G has spent approximately $1.6 million on robotic hardware purchases and development. Savings associated with the use of the robots totaled approximately $5.3 million. As a general rule, for every dollar invested in robotic applications, PSE&G has realized operating cost savings of $2-3. Table 1 shows the installed and/or total developmental costs associated with all the robots and remotely operated equipment purchased under the program, plus an estimated listing of savings. Conclusions drawn from the PSE&G experience are:

- Robots are highly cost effective.
- Current and future projected radiation protection-related cost savings from the use of robots is enough to justify their purchase, development, and application.
- Robots used on the secondary side of steam generators are likely to achieve significant savings and forestall expensive steam generator maintenance and/or replacement.

For more, "The Economics of Robots in Nuclear Power Plants," by R.F. Brandt, F.A. Marian, J.J. Molner & H.T. Roman, Radiation Protection Management, Volume 10, No.1, pp. 35-44, January/February 1993.