Radiation tolerant camera systems

HIGH RESOLUTION COLOR PTZ CAMERAS FOR LONG SERVICE CONTAINMENT SURVEILLANCE
Radiation tolerant surveillance

Today’s modern nuclear power plants require efficient and reliable process surveillance systems for the monitoring of critical components within containment areas in order to promote NPP safety and economy.

Now there is a new solution on the market that can fulfill these requirements – RADCAM by ISEC. RADCAM not only addresses the full radiation problem – both gamma and neutron radiation, but also provides a new level of image quality, reliability, ease of integration and a service life that easily spans plant operational cycles. The RADCAM also incorporates state-of-the-art cooling systems and the possibility to perform complete in situ camera servicing in only a few moments. This fully supports ALARA efforts and ensures a surveillance system with 100% availability throughout the production cycle and beyond.

RADCAM is the new industry standard for radiation tolerant process surveillance systems. It has been specifically developed together with, and for, the NPP industry. The result is a camera system designed to do the job better than any other system on the market. When combined with our optional AVISS software and IVS matrix system, we can offer the most radiation tolerant surveillance system ever.

- Unique radiation protection
- High quality imaging
- Long service life
- Modular design
- Fast, easy and safe maintenance
- Smooth integration
LEADING RADIATION TOLERANT CAMERA SYSTEMS

new NPP industry standard

Six years in development
RADCAM has been developed in close collaboration with Sweden’s Forsmark and Ringhals nuclear power plants. Our goal was to design a camera system that could easily last between fuel-change cycles, give optimized operator functionality and fast, easy and safe maintenance as well as smooth integration with existing systems. We also aimed to improve the image and audio (optional) quality and increase the ability to monitor, check and analyze all processes, activities and events that occur during both production and outages.

In reactor testing
Together with Ringhals, we started side-by-side testing of the RADCAM prototype and a typical NPP surveillance camera at full capacity production. The standard camera soon showed heavy image degradation and loss of pixels, while the RADCAM’s high-quality image was virtually unaffected. We were not surprised.

Gamma radiation causes gradual degradation of the image, but not hot spots with dead pixels. On the other hand, neutron radiation quickly results in hot spots, and can render the camera useless in a matter of months.

100% availability
The new RADCAM has already proven itself by contributing to better plant economy and safety. Its high image quality and 25x optical zoom vastly improves the image presented to the operators, even in low light. This makes continuous monitoring, confirmation and analysis possible. Using mechanized inspection rounds, and outage surveillance, REM exposure can be lowered and personnel safety improved with a system that is fully functional throughout the scheduled production cycle, and beyond.
Plant equipment problems are a major, direct cause of unscheduled outages and scrams. An improved and reliable process surveillance system will also improve the decision-making process.

Many of our clients have stated that “a RADCAM system will help to increase the utility factor and even reduce the duration of scrams and unplanned outages. Typically, a RADCAM system can shorten the annual unplanned outage time, giving it a ROI of less than one year. It also complements ALARA efforts, making it possible to lower exposure time and REM doses”.

Improved control and planning
Searching for smoke and fire, sources of steam and oil leakages, visual confirmation of executed control room orders, and viewing of manometers are typical examples of RADCAM usage. In the case of incidents, the RADCAM adds important action plan information. Its high-quality imaging, and capacity for precise close-up viewing, can help clients choose a scenario with reduced power instead of initiating a manual scram. It can also mean increasing the scram countdown time from minutes to hours. RADCAM can also provide minute-by-minute documentation of different processes, and can be set to constant camera monitoring of specific occurrences.

With RADCAM, planning the maintenance activities for the next scheduled outage is easier, as is the recording of all critical problems or incidents when used with ISEC’s IVS system. This ability to improve planning is in itself an important factor in increasing the utility factor.

Outage, refuelling and testing
During scheduled outages, RADCAM can be used as an added security system, aiding the personnel working in the containment area. Regular testing of tube circuits, valves, manometers, shunts and other equipment are other typical RADCAM tasks, as is the training of new personnel, helping them to become familiar with the containment area.

Use of the RADCAM in the EDF +50 reactor fleet could result, conservatively estimated, in at least one day of saved production per year, per reactor, based on 17 currently monitored targets.

CNPE
EDF, France

The ability to check on the process at any time has given us the opportunity to detect leaks, loosening parts and other minor malfunctions at an early stage. This has enabled us to decide, in good time, how to handle the situation before it becomes serious.

Forsmark 2
Vattenfall, Sweden

I would estimate at least a 30% reduced radiation count for work in high radiation areas during production. The use of cameras is not only a safety issue, in my opinion they are also a good investment in reliable production.

Forsmark 2
Vattenfall, Sweden
True radiation protection for long service life

The unique radiation protection of RADCAM extends the life of the camera and electronics well beyond a typical full fuel-change cycle. The estimated service interval is 2-10 years, depending on the radiation levels at the specific camera placement point. This means less required servicing and maintenance between and during scheduled outages, and most importantly, it helps to provide 100% system availability.

- Neutron protection
- Gamma protection
- Protected position
- Protected camera and control module
- Reinforced components
- All electronics inside the shell
- Radmonitor – integrated radiation detectors

Neutron-absorbing outer body

RADCAM uses a unique neutron-absorbing outer body, plus internal gamma radiation protection. RADCAM is the only NPP camera on the market with neutron radiation protection. Its patented body design puts RADCAM in a class of its own.

Protected position

When not in use, the camera automatically goes into protected position, with the lens opening facing the rear module. This protects the lens from contamination and minimizes the effect that neutron radiation has on the camera and control module.

Protected camera and control modules

Both the camera module and all control electronics responsible for the camera movement – pan, tilt, zoom – are contained within the protective shell and thus heavily shielded. This ensures continued operation during production, and also easy installation, since only two cables are needed for controlling camera movement.

Unique radiation damage diagnostics

With our radiation damage diagnostic system, Radmonitor, our clients can download the camera status data during production that ISEC’s specialists then can analyze and diagnose. The Radmonitor report clearly indicates the expected life span – in weeks, if not in days – of ISEC equipment in the containment area. This provides an excellent tool for cost-effective maintenance and service planning. ISEC is the only company providing this truly high-tech analysis solution for live radiation measurement and diagnosis.
Radcam technical overview

Internal cooling systems

Effective cooling of the camera results in a much improved image quality, but also prolonged camera module and control module life. The twin cooling systems in RADCAM consist of separate fans and heat sink units for the front and rear of the camera body. The system is designed to withstand continuous high temperatures and because the heat sink units are external, there is no internal air circulation. This means less contamination of the internal camera module and control module.

- Twin cooling systems
- External fans and heat sinks
- 149°F (65°C) operating temperature
- Peak temperature 194°F (90°C) for 8 hours
- Low internal temperature

Fast & easy maintenance

RADCAM has a modular design with few spare parts, meaning fast and easy maintenance. RADCAM also provides an intelligent camera system that stores and logs all significant camera activities for easy download.

- Modular design
- Easy and user-friendly maintenance
- Few spare parts
- Unique and easy extraction of camera data
- Self diagnostics help maintain optimum camera status

The camera module, halogen lights, and fans can be swiftly replaced in only minutes. All actions can be done using typical radiation protective clothing and gloves.

With its dedicated test program, it is easy to do a full camera system check. The service keyboard on the control board makes testing of different functions easy, even when the camera is not connected to a control system.
High-quality imaging

State-of-the-art color imaging and powerful halogen lamps are behind RADCAM’s ability to monitor minute details, even in low light conditions. The RADCAM is maneuvered using variable PTZ speeds, which simplifies both manual and pre-programmed inspection rounds. Incidents and problems are easily recorded with high-quality images for subsequent troubleshooting.

Field-tested camera for optimum image quality

During our six-year development of RADCAM we field-tested a number of different camera options. The specific camera module used in RADCAM offers a very good 0.7 Lux light sensitivity and very low noise (high S/N ratio), both of which are important aspects considering the typically low light conditions at nuclear plants.

As described above, the efficient cooling of the camera and its sensor adds considerably to the quality of the images from RADCAM.

Precise camera maneuvering

All camera movements are controlled either by the dedicated operator panel and joystick, or by mouse when used with ISEC’s IVS system. All movements can be done at variable speeds to suit the needs of the individual operator, and with camera positioning precision down to 0.01°, making maneuvering and monitoring exceptionally accurate and precise.

Halogen lamps

The twin halogen lights – flood and spot – can be used simultaneously or one at a time. This vastly improves the ability to monitor the containment area and achieve good images even in low light conditions. The spot lamp has an effective range of over 65 feet (20 meters), and the flood lamp gives excellent floodlight illumination.

Optional audio

Adding the optional microphone, further increases the ability to analyze the in containment process, combining image and sound.
For more than twenty years, ISEC has provided high-tech process surveillance systems to nuclear power plants and other industrial facilities world-wide.

Since 2003, our focus has been strictly on surveillance solutions for the nuclear industry, with the explicit goal of providing process surveillance systems with 100% availability during operational cycles. Our unique products, RADCAM (radiation tolerant camera systems), IVS (digital and analog video matrix systems), and AVISS (NPP dedicated audio visual information systems) are market-leading solutions in this area.

ISEC has a proven track record with existing NPP installations in Sweden, France, Switzerland, Japan and ongoing projects in the EU, USA and Asia.

Our know-how in nuclear power plant applications and our ability to design, deliver and support customized systems with outstanding availability, quality and survey functions have resulted in a very high degree of client satisfaction and very positive NPP market response.

100% availability. 100% client satisfaction.

ISEC – experience and know-how

Contact Info:
BHI Energy | Bartlett Nuclear, Inc. AMS
bill.peoples@bhienergy.com
800.225.0385 x 1387
407.339.6113

Authorized USA Distributor