

**Don't allow fuel element failure to contaminate your primary loop!**

## Sentinel™

### Digital Failed-Fuel Spectrometer

- Monitors concentrations of fission and activation products in the primary coolant to detect impending fuel element failure
- Provides unmatched STABILITY and reliability even under conditions of varying count rate and temperature
- Provides graphic display of concentration levels
- Monitors user-defined alarm levels
- Performs QA checks automatically on its own performance
- Includes powerful, flexible networking options

## The Problem

Each fission reaction in the fuel of a nuclear reactor produces two fission fragments which share an average of 167 MeV of kinetic energy, with each fragment's share being inversely proportional to its mass. Among the fragments are xenon and krypton. As the concentrations of these gases increase, the fuel expands and exerts pressure on the cladding. The start of cladding rupture is observable by an increase in the concentration of those gases and then by radioiodine in the primary coolant.

Radioactivity concentration levels in the coolant of nuclear power plants typically vary widely. However, careful examination of the gamma-ray spectrum with a germanium detector system allows one to compare the short half-life fission gases and the longer-lived fission products to determine if the concentration level is "normal" or is due to the onset of fuel element failure.

## The Measurement Requirements

An easy-to-use, **reliable** system is required, with **high sensitivity, wide dynamic counting range, high throughput capability, excellent stability under conditions of varying temperature, and proper quality assurance.** The answer to all that is the world's first Digital Failed-Fuel Spectrometer, **Sentinel.**

Sentinel from ORTEC is more stable and more easily optimized to any count rate environment than anything on the market. The Sentinel is a completely integrated system that tracks and plots user-designated radionuclides and alerts indications of incipient fuel element failure.

## Sentinel's Key Component

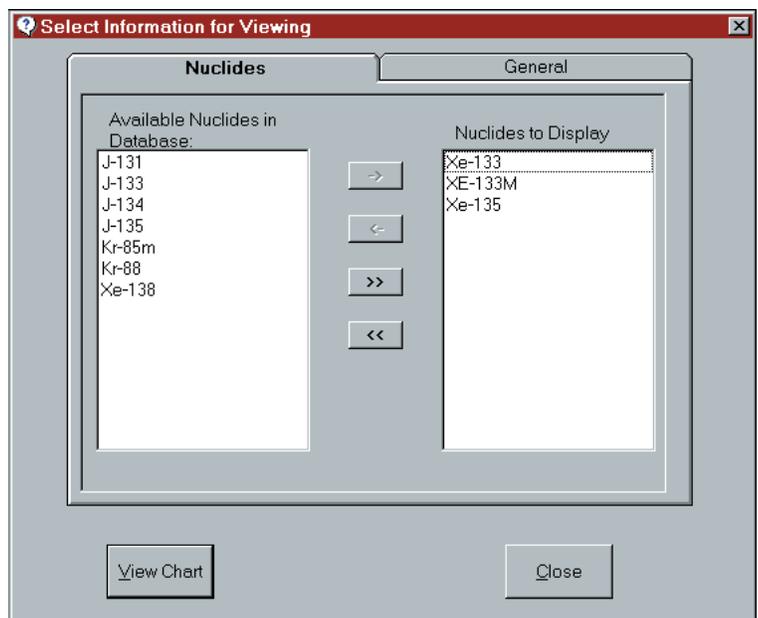
At the heart of the Sentinel is DSPEC Plus, the gamma-ray spectrometer employing DSP (Digital Signal Processing) technology. The Sentinel provides **unmatched stability** despite varying **count rate** or **temperature**, and is therefore ideally suited to **automatic monitoring** applications. Sentinel operates under Windows® 2000/XP, either on a single PC or a PC network. Software is **native 32-bit!** Expensive custom software, custom shield designs, and on-site system integration will become distant memories.

To keep your plant clean by detecting the first signs of fuel element failure, you need . . .

## The Sentinel Digital Failed-Fuel Spectrometer . . .

The Sentinel acquires spectra, tracks activity levels in user-defined regions-of-interest, automatically performs calibration checks, monitors alarm levels, stores data, and automatically performs quality assurance procedures on check-source data.

All activities are carried out by GammaVision and GV-Online software (both native 32-bit applications), running on either a local or remote PC.



The User Can Select Nuclides from a Predefined Library for Tracking and Plotting Concentrations.

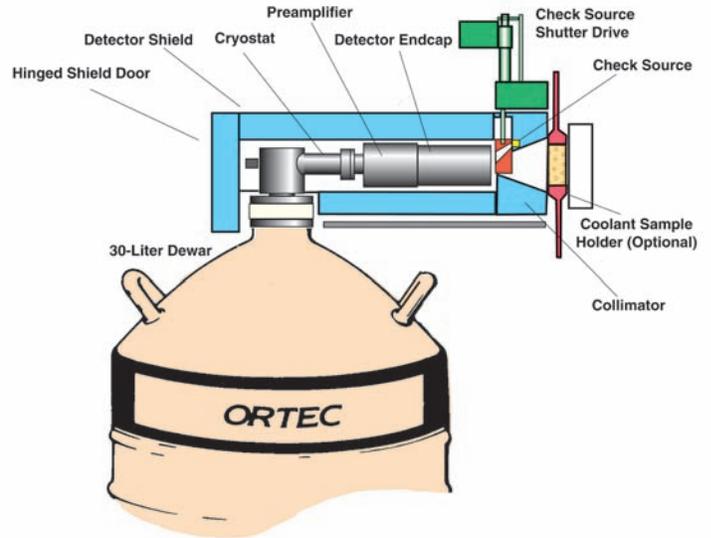
# Sentinel

Digital Failed-Fuel Spectrometer

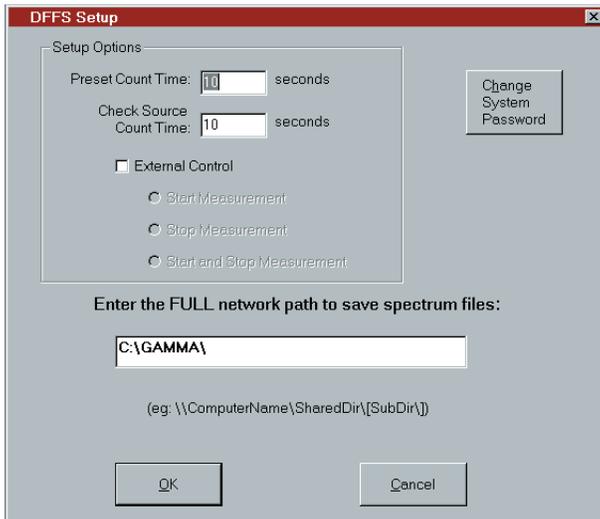
Model OS5400

## Construction

The detector cabinet contains the shield assembly, liquid-nitrogen supply, check source, and a 25-mm diameter GLP planar germanium detector, which provides exceptional energy resolution at low and intermediate photon energies. A selected preamplifier feedback resistor accommodates the high count rates expected. The detector has a rugged ion-implanted front contact which eliminates x-ray spectral interference that is inherent in a less reliable metal contact. The detector is surrounded by a lead shield assembly that includes a detector collimator. The shield assembly is hinged and the detector mounted on a sliding drawer to facilitate easy removal from the shield and detector cabinet.



Simplified View of the Sentinel Detector Shielding and Sample Changer.



Setup Page Including Quality Assurance Parameters.

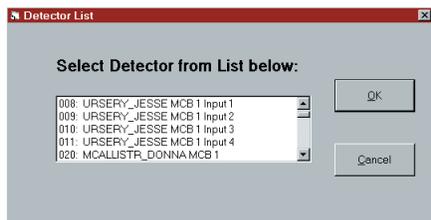
## Quality Assurance

To verify proper operation, a check source is automatically actuated on a user-defined schedule, typically daily. The check source data is collected in a separate data file for QC checks of the system response.

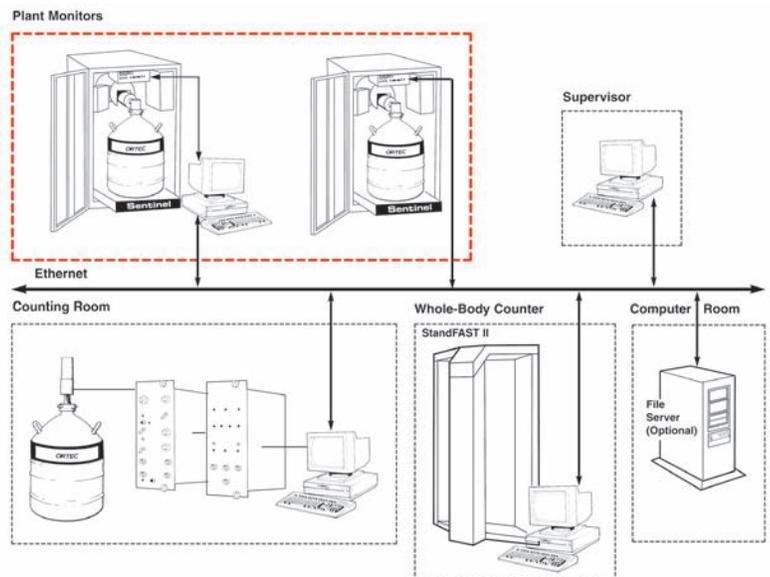
The check source, built into the collimator, is used to confirm energy calibration and verify gain stability. The frequency of the check source cycling is chosen by the user, with data storage and QA checks performed automatically.

## Network Operation, the Way You Want It

The Sentinel, with its ORTEC heritage, installs easily to existing Ethernet networks. Depending on a particular installation's requirements, the Sentinel can be controlled via the network or by a local PC. Sentinel has built-in Ethernet and dual-port memory support.



Detector Selection List Accessible from the Network.



A Typical Plant Network System.

## Security Built In

In addition to standard ORTEC selectable password protection, the system, has DOD "Level C2" security features. (For more information on ORTEC's built-in security features, ask for the brochure, "Spectroscopy Software with CONNECTIONS.")

## Ease of Installation

Because ORTEC understands the ponderous requirements placed on Instrumentation and Control group at nuclear facilities, we have made certain that Sentinel installation will proceed smoothly and easily.

## Complete Operation and Maintenance Documentation

Sentinel arrives with complete Operation and Maintenance manuals plus shop test data. The **Operation** manual includes all information required by a user to start up, set parameters, set alarms, and to acquire and manipulate data. It also includes explanatory drawings, figures, and both theoretical and practical background knowledge. The **Maintenance** volume includes calibration, repair, and routine maintenance procedures plus as-built drawings, schematics, wiring diagrams, spare parts lists, test procedures, and installation drawings with instructions.

## Options

Customize your system with a choice of options:

- Electromechanical (non-liquid-nitrogen) detector cooling
- Strip-chart recording of concentration data at local or remote locations
- Local and remote alarm outputs and displays
- Choice of personal computers: laptop, desktop, industrial grade, or complete control consoles

## The Extra Support You May Need

In addition to the listed hardware options, ORTEC has an Integrated Systems Group that is ready to modify hardware and software to your particular requirements. Isn't that nice to hear?

## The ORTEC Promise

We guarantee that what is provided will (1) operate as specified and fulfill the intended purpose, (2) be well documented and appropriately supported, and (3) that the measurement results will be verifiable. These are our absolute commitments to you!

## Ordering Information

Contact ORTEC or your local representative.

Specifications subject to change  
050307

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