

CIDASTM Mk X Criticality Incident Detection and Alarm System



CIDAS™ Mk X

Criticality Incident Detection and Alarm System

“A performance proven, highly reliable and flexible system which meets all your individual criticality needs”.



Pajarito Scientific Corporation (PSC) is proud to be the exclusive North American provider of BIL Solutions, Ltd. Products, including the CIDAS – Criticality Incident Detection and Alarm System.

Any plant where nuclear material is refined, enriched, fabricated, used, stored, reprocessed or disposed should consider the installation of a criticality incident detection and building evacuation alarm system.

The immediate detection of criticality incidents and the subsequent rapid evacuation from exposed areas can significantly reduce personnel dose uptakes should criticality control measures fail. Even in shielded areas

CIDAS is shown to be effective in such conditions with its comprehensive detection and alarm capability and exceptionally rapid reaction times.

CIDAS Mk X represents the latest development of this proven criticality incident detection and alarm system which was pioneered at BIL plants in the early 1960's.

This latest version enhances performance even further with the incorporation of the latest solid state logic based technologies, automatic testing and diagnostic routines.



CIDAS™ Mk X

Criticality Incident Detection and Alarm System

“The complete monitoring solution for your plant, backed by over 30 years of operational experience”

- Highly reliable detection of criticality incidents
- Low maintenance and high availability
- Very low spurious alarm rate
- Modular system can be configured for large or small facilities
- Simple detectors allow cost effective wide area coverage
- Meets the European and USA standards for criticality detection
- Proven detection capability
- Complete ‘turnkey’ package



A CIDAS Mk X System is installed within the fuel fabrication facility at the United Kingdom Atomic Energy Authority (UKAEA), Dounreay, Northern Scotland.

The CIDAS System supports the UKAEA’s objective of achieving maximum operational safety during the production of research reactor fuel.

“We chose the CIDAS Mk X system because it offered compliance with all national and international statutory regulations”

Mr Ian Maycock, UKAEA Engineering and Contracts Manager



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How CIDAS Works

CIDAS Mk X is a versatile modular system with a range of components which can be selected and configured to meet the requirements of individual facilities, whether large or small.

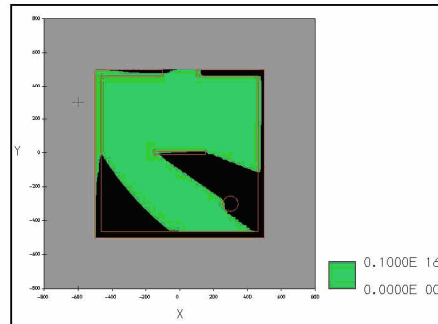
CIDAS Mk X is based on the use of simple gamma detectors located around the areas where a criticality is deemed possible. The detectors have been specifically designed to detect the excessive radiation dose which occurs during a criticality. Each area is monitored by detectors arranged on triplicate rings. Tripping of at least two out of the three detector rings will automatically initiate the building evacuation system to sound alarms for the immediate evacuation of personnel.

During normal plant operating conditions a confidence pip tone can be sounded to indicate that the system is operational. If a system fault is detected the pip tone will be silenced.

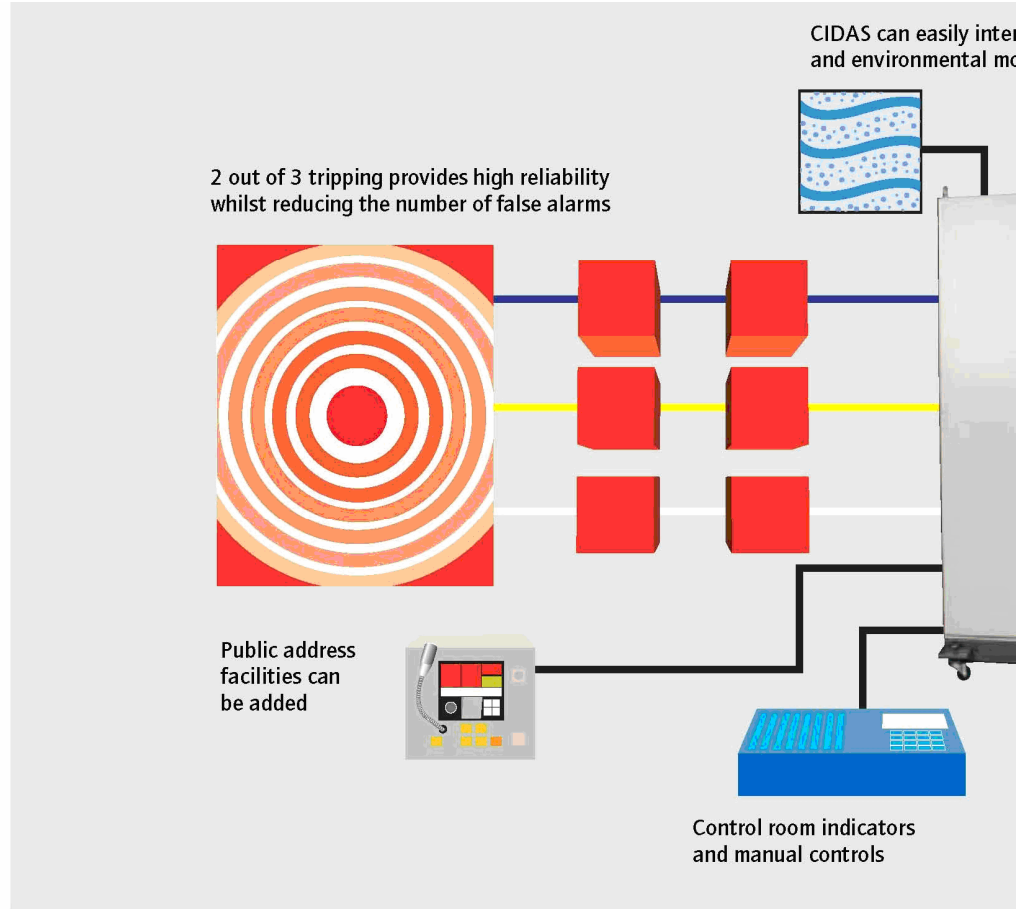
Detector Placement Determination

Before installation all detectors are calibrated on a high dose rate facility at BIL's Sellafield plant to ensure they meet the required specification.

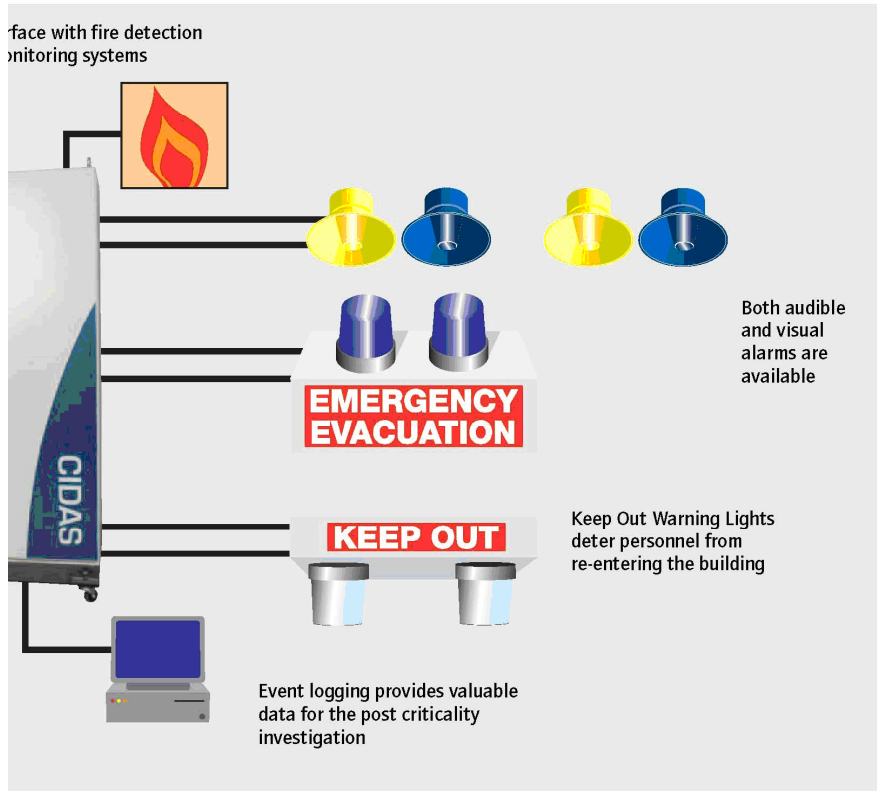
Accurate positioning of detectors is necessary to ensure they do not trigger during normal plant operations but are guaranteed to trigger in the event of an incident.



Building structures may shield areas from a single detector. A criticality incident occurring within the area shaded black would not be detected by a single detector (+).

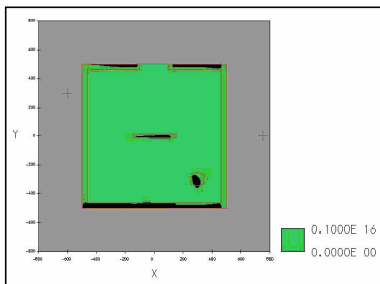
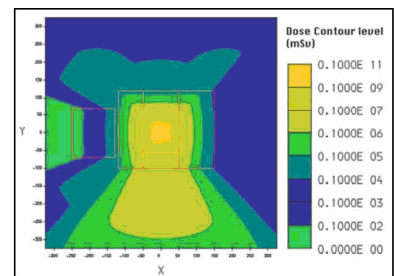


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Contour Maps

Emergency planning contour assessments can be performed to define the Criticality Evacuation Area and ensure personnel are evacuated to a safe distance following a criticality incident.



Where necessary expertise can be provided to accurately determine the number and position of detectors. This involves modelling of a plant to prove detectors would trigger should a criticality occur within the defined area.

Detectors are usually placed out of cell for easy testing and maintenance.

Addition of subsequent detector ensures complete coverage of a criticality area. This process is repeated for each of the three detector rings.



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Proven Success

The Mk X version of CIDAS represents the latest development of this proven criticality incident detection and alarm system which was pioneered at BIL plants in the early 1960's

To date more than 50 CIDAS systems have been successfully installed at major nuclear sites.

“We chose CIDAS because it offered us a technically excellent solution at a very competitive price.”

Dr. Dave Huyton, Pu Finishing & Storage,

BIL, Sellafield.



Pu Finishing and Storage



OFC

A CIDAS system is operational within the Oxide Fuel Complex, BIL, Springfields, UK, one of the world's most advanced PWR and AGR fuel manufacturing plants.



Uranium Enrichment Plant

CIDAS was installed within the new Uranium Enrichment Plant, URENCO (Capenhurst) Ltd. Additional CIDAS Mk X detectors have recently been added to this system.

Photograph by courtesy of URENCO (Capenhurst) Ltd



Fuel Reprocessing Plant

“CIDAS has been operating reliably within BIL Sellafield Reprocessing for over 25 years.”

Mr. Mel Bibby, Project Manager,
Electrical and Instrument
Projects, BIL, Sellafield



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System Capability

- In-cell and out-cell gamma detectors
- Visual and audible alarms
- Warning lights to prevent re-entry to evacuated areas
- Status information for each detector
- Automatic self-testing

Set up and Operation

Gamma detectors are positioned around areas where criticality is deemed possible.

Detectors located in the field are wired back to the CIDAS logic panel on triplicate rings with any two out of the three tripping required to initiate the evacuation alarm. Other redundant arrangements can be provided as required e.g. one out of two, two out of four etc.

Trip signals from the detectors are processed by solid state system logic based on that used for petrochemical plant shutdown systems. No software is used in the alarm path.

The alarm is raised via a duplex audio building evacuation system or solid state sounders. Noisy area warning lights are also available.

The CIDAS logic and building evacuation panel is housed in a

standard swing frame enclosure.

Alarms are sited throughout the criticality evacuation area with keep out warning lights at entrances to deter re-entry.

System Configuration

The schematic (centre pages) shows the optional hardware making up the CIDAS system.

The system is modular and can be configured to meet the requirements of individual facilities either large or small.

Up to 150 detectors can be connected to a single logic unit, systems are available with over 800 detectors.

Transportable System

If a full criticality detection system is not required a smaller transportable system providing highly reliable detection can be provided. Such a system can be easily transferred from one building to another.

Calibration & Testing

All detectors are tested and calibrated on a high dose rate facility at BIL's Sellafield plant prior to installation to ensure they will function correctly during a criticality event.

The detector circuit itself and all the components of the trip circuit have been tested on the VIPER reactor at Aldermaston. This testing is essential

for criticality systems to ensure that they can operate through the very high dose rates which occur.

System Self Checks

CIDAS has in-built facilities for the constant checking of system parameters. These include field cabling from operator consoles, detector and loudspeaker cables, logic circuit decisions, continuity of power supply status, building evacuation tone generator faults, amplifier faults and fuse failure. These extensive diagnostics provide excellent system availability with fewer plant shutdowns due to loss of protection.

Any faults revealed by the self checking will silence the confidence pip tone which is broadcast constantly to indicate that the system is operational. This tone can be muted if required.

Reliability

The combination of two out of three voting on detector tripped signals, duplicated audio evacuation signals and diverse power supplies means that the CIDAS system can claim very high reliability figures. The systems are designed so that no single equipment failure will leave the plant without criticality detection cover. In addition, duplicated decision logic and building evacuation system outputs allow maintenance while the system is still on-line.



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Performance

Probability of failure to alarm on demand:	10 ⁻⁴ (subject to detector testing frequency)	
Spurious alarms:	less than 1 in 10 years	
Response Times of detectors:	Dose Rate	Time to Respond
	150µG/hr	Does not trigger
	1mGy/hr	< 1 sec
	1Gy/hr	< 1msec
Time to Alarm:	Less than 200msec	

Standards

CIDAS meets or exceeds the following standards: ANSI/ANS 8.3, IEC 860, ISO 7753, SRD R 309, NF0079/1, NF 0072/1, low voltage directive (73/23/EEC) and electromagnetic magnetic compatibility directive (89/336/EEC) as amended by directive (92/31/EEC).

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