400 Series:
Process Safety

EHS Alarm Management

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Global Environmental, Health and Safety
Indorama Ventures

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1. Purpose

This standard establishes Indorama Ventures process and minimum requirements for assessing and managing the performance of process alarms to fulfil their safety and environmental related functions.

2. Scope

This standard applies to all Indorama Ventures owned/operated sites that have safety and environmental related process alarms. This standard does not apply to joint ventures (JVs) in which Indorama Ventures is a minority owner, nor to third-party warehouses and tollers, unless specifically requested by the related Segment EHS Leader.

For the purpose of this standard, the term 'EHS' includes process safety, transportation, and security, as well as environmental, health and safety.

This standard must be implemented by each site. Until implementation of this standard is complete, each site must at a minimum be in compliance with the local applicable regulations.

3. Responsibilities

Following is an overview of key responsibilities for this standard. Additional responsibilities, as applicable, are included in Section 4, Requirements.

3.1. Corporate EHS

3.1.1. Provide ongoing technical assistance related to this standard.

3.1.2. Periodically audit sites to determine compliance with this standard.

3.1.3. Review, update and communicate to all Indorama Ventures sites any updates or changes to this standard and associated documents and tools.

3.1.4. Periodically review this standard to ensure its continuing adequacy and suitability to Indorama Ventures operations.

3.1.5. Ensure this standard is consistently implemented from site-to-site within Indorama Ventures.

3.1.6. Communicate, as applicable, any lessons learned as a result of best practices identified or any non-compliances associated with implementation of this standard.

3.2. Site Head or Designee

3.2.1. Ensure implementation of and compliance with this standard including that it is adhered to and that all personnel receive the proper training, resources, and communications.

3.2.2. Assist with the implementation of this standard; in particular:

- Be thoroughly familiar with the requirements of this standard and any associated procedures and work practices.
- Provide support, resources and training needed to carry out the requirements of this standard.
- Ensure required records are maintained on file.
- Ensure compliance with this standard by personnel (as applicable).

3.2.3. Appoint Alarm Management Leader(s) to manage the work effort.

3.2.4. Ensure that local compliance audits are carried out in accordance with Attachment F.

3.3. Segment EHS

3.3.1. Ensure that any site or local standard or procedure related to the same topic follows the corporate requirements at minimum.

3.3.2. Support the sites on any technical point related to the standard, including implementation.

3.3.3. Periodically evaluate sites' level of compliance with this standard.

3.4. Program Owner

3.4.1. Be thoroughly familiar with the requirements of this standard and local regulatory requirements.

3.4.2. Develop and implement a site-specific program that meets the requirements of this standard and any local/regional regulatory requirements.

3.4.3. Periodically review and monitor for compliance with the requirements of this standard, and per local regulatory requirements, at least every five (5) years.

3.4.4. Develop an action plan to correct any non-conformance with local regulatory or Indorama Ventures requirements.

3.5. Project Managers

3.5.1. Ensure compliance with this standard for capital projects and appoint Alarm Management Leader(s) to manage the work effort.

3.6. Alarm Management Leaders

3.6.1. Approve the Alarm Design Philosophy document.

3.6.2. Define alarm system performance review frequency.

3.6.3. Ensure there is a process for the investigation and correction of causes of nuisance alarms.

3.6.4. Form an appropriate Operational Review Team.

3.6.5. Ensure competent persons carryout the alarm maintenance.

3.7. The Operational Review Team

3.7.1. Conduct regular operational reviews of the alarm system (reference Attachment F)

3.7.2. Conduct regular reviews of the top ten alarms.

3.8. Employees and Contractors

3.8.1. All personnel must understand and follow the requirements of the site-specific program including:

- Being aware of and trained on, as applicable, the legal, regulatory and other associated requirements.
- Immediately reporting any situations that may cause or have a potential to cause a non-compliance.

- Completing any assigned regulatory tasks or actions.
- Being aware of and trained on the process safety information relevant to the process(es) they operate and/or maintain.

3.9. In addition to the roles and responsibilities detailed above, the site-specific program must define and document the roles and responsibilities for all personnel who play a role in implementing the site-specific program, at a minimum:

- Supervisors
- Engineering and Maintenance
- EHS Personnel
- Other applicable functions, as staffed at individual site level

4. Requirements

The site shall develop and implement a written site-specific program which meets local regulatory requirements, and, at a minimum, fulfills the requirements in accordance with this standard.

4.1. Alarm Management Leader shall be assigned by the Site Head or Project Manager for capital projects. There may need to be more than one Alarm Management Leader. For example, there are Distributed Control Systems (DCS) and other logic solver related alarms that are typically covered by the plant DCS group, and then there are hard wired alarms that might be dealt with by the Electrical/ Instrumentation (E/I) group of the plant.

4.2. All alarms and alarm systems, both EHS Critical and non-EHS Critical, shall be identified, documented, and maintained, as detailed in Attachment B. The identification of EHS Critical equipment is detailed in IVL EHS-405, Criticality Assessment Standard.

4.2.1. Hardwired alarms (not routed through a DCS or similar system) are covered by this standard. The same principles apply even though audit capabilities, the ability to know when the alarms activate and the ability to develop KPI information, will be very different.

For non-DCS systems, an alternative method of data collection will be required. This could involve installing a dedicated electronic logging system or more likely keeping manual logs. In the latter case it is likely that taking regular samples would be sufficient rather than constant logging.

4.3. An Alarm Design Philosophy document shall be produced for each unit / plant in accordance with Attachment C and approved by the Alarm Management Leader(s). This shall include prioritization of all the alarms. Guidelines for alarm prioritization are given in Attachment D.

4.3.1. Alarms designed within the operator interface shall be prioritized and shall be visually distinguishable by operators.

4.4. A management system shall be put in place to monitor the alarm system performance.

4.4.1. Key Performance Indicators (KPIs) and target values shall be defined (see Attachment E).

4.4.2. Where the performance of the alarm system is consistently failing to meet the target values for the KPIs, an alarm rationalization process shall be initiated. For guidance see Attachment B.

4.4.3. It is good practice to hold reviews of the alarm KPIs monthly, but the interval may be varied to suit local circumstances.

4.4.4. A review system (see Attachment F for guidance) shall be established to evaluate the alarm system performance against the target values for the KPIs.

4.4.4.1. The Alarm Management Leader(s) shall form an appropriate Operational Review Team. This team shall conduct regular operational reviews of the alarm system and top ten alarms.

4.4.4.2. The Alarm Management Leader(s) shall ensure there is a process for the investigation and correction of causes of nuisance alarms.

4.4.5. Where necessary, remedial action shall be initiated to ensure that the target performance is achieved (for typical actions see Attachment G).

4.5. Changes (including disabling / by-passing) to the alarm system shall be managed via IVL EHS-204, Management of Change (MOC) Standard. Where there is an equivalent change control process (e.g., alarm bypass control), it shall meet the content and intentions of the MOC standard.

4.6. A log of disabled alarms and the rationale for disabling them shall be kept and maintained.

4.7. Operators shall be trained on the required response to all alarms and in the use and features of the alarm system (see Attachment H for guidance). More specific training shall be provided for EHS Critical alarms (see H.3).

4.7.1. Appropriate operators shall formally review the log of disabled alarms at the beginning of each shift (see IVL EHS-412, Operating Procedures (to be issued at a future date).

4.8. The alarm system shall be maintained by a competent person, which the Alarm Management Leader(s) shall verify.

4.9. Alarms shall be maintained and tested in a manner appropriate to their priority (See Attachment D for guidance).

4.9.1. Alarms associated with Safety Instrumented Functions (SIFs) shall be maintained and tested in accordance with proof test requirements established per IVL EHS-409.

4.9.2. Alarms credited with risk reduction as an Independent Protection Layer (IPL) shall be maintained to achieve the availability and integrity in accordance with the site's philosophy for maintaining Basic Process Control System (BPCS) IPLs.

4.10. New projects shall be executed in compliance with this standard.

4.11. The alarm logging system shall be backed up and records kept for a minimum of one year, unless local regulations state otherwise, or in the event of an incident. Alarm data for incidents needs to be extracted and retained for a longer time period than normal alarm log data, as appropriate.

4.12. Alarm design data (such as the Alarm Design Philosophy document and the list of Alarms) shall be kept for the life of the asset.

4.13. Timing

4.13.1. A regular process of reviews shall be carried out in accordance with the schedule established by the Alarm Management Leader(s) and the Site Head (reference guidance in Attachment F).

4.13.2. Local compliance audits shall be carried out at least annually (see Attachment F).

5. Training

Training requirements must be defined for site-specific alarm management. At a minimum, all training must be documented with the training date, the names of personnel trained, the names of the trainer(s), the content of the training (or reference to content) and other site-specific/business segment requirements, when applicable.

5.1. Initial

Training on the requirements of this standard, including specifics of Attachment H, and the site-specific program must be provided to Indorama Ventures personnel based on their relevant responsibilities and shall be provided in the local language. At a minimum, personnel and/or management with direct responsibilities for this standard and site-specific program must be trained prior to conducting activities associated with the site-specific program.

5.2. Refresher

Refresher training shall be provided periodically according to the requirements of this standard, the site-specific program (including specifics of Attachment H), and any local legal requirements, at appropriate intervals (e.g., changes to regulatory requirements, observed user deficiencies, increased area classification/management-related injuries/incidents), or at least once every three (3) years.

6. Recordkeeping

Records associated with this standard, site Alarm Management, and/or site-specific regulatory requirements must be controlled and retained in accordance with regulatory or site business segment record retention requirements, whichever is more stringent. Examples of records to be maintained include but may not be limited to lists of EHS Critical and non-EHS critical alarms, alarm design documentation, as well as all data required to be documented for the alarms. Refer to the documentation requirements listed in Attachment B.

7. References

7.1. IVL EHS-104 Organizational Change Management

7.2. IVL EHS-204 Management of Change

7.3. IVL EHS-208 Risk Management Standard and Matrix

7.4. IVL EHS-405 EHS Criticality Assessment

7.5. IVL EHS-406 Independent Protection Layer Assessment Methodology

7.6. IVL EHS-409 Design and Maintenance of Safety Instrumented Functions (Plant Trips)

7.7. IVL EHS-412 Operating Procedures (to be issued at a future date)

7.8. EEMUA 191, Alarm Systems, A Guide to Design, Management and Procurement, edition as applicable to design

Note: Many of the guidelines in this standard are drawn from EEMUA 191.

8. Terms and Definitions

See IVL EHS Glossary and Attachment A.

9. Revision History

Version	Date	Summary of Update	Owner	Approver	Next Review Date
Original	August 2023	Initial Release	Chad Wyble, Global Process Safety Program Director	Todd Hogue, VP, Global Head of EH&S	August 2028
1.0	09 August 2024	Updated implementation timeframe (Section 2) and Responsibilities (Section 3); made minor editorial updates.	Chad Wyble, Global Process Safety Program Director	Todd Hogue, VP, Global Head of EH&S	09 August 2029

Attachment A: Definitions and Glossary

A.1 Alarm

An alarm is an event which is signaled to the operator visually and/or audibly. It alerts the operator of an abnormal situation which requires an operator response. An alarm does not cause any action to affect the operation of the site. It is the operator's responsibility to carry out any required actions. When the alarm first occurs a visual and/or audible signal will be given. The operator must manually accept (acknowledge) the alarm in order to stop the visual and/or the audible signal.

Note: the alarm subsystem of a programmable system (DCS, PLC, etc.) may be used to initiate control actions or notifications, but these are not considered to be alarms unless it alerts the operator of an abnormal condition, and an operator response is expected and required.

A.2 Alarm Design Philosophy

This is a document intended for personnel involved in the design and/or modification of the site or executing projects. It gives detailed design criteria for the engineering of alarms and who is responsible for its management. It is usually site specific. See Attachment C for guidance on its contents.

A.3 Disabled Alarm

An alarm which has been prevented from functioning by either hardware or software means. Other terms sometimes used are: shelved, overridden, bypassed, and inhibited.

A.4 EHS Critical Alarm

A.4.1 An alarm credited as an Independent Protection Layer that protects against the consequence severities A thru F, shall be considered EHS Critical. Its role can be direct or indirect.

A.4.1.1 In the direct case the operator must respond to the alarm to prevent a hazardous event from occurring. It is essentially a Safety Instrumented Function (SIF).

A.4.1.2 In the indirect case the hazard is prevented from occurring by a trip system. However, the operator's response to the alarm has been used to justify the Safety Integrity Level (SIL) assessment of the trip system, for example in a Layer of Protection Analysis (LOPA). It is a Risk Reduction Factor (RRF).

A.4.2 For hazards affecting outside of the site boundary, see section 4 of IVL EHS-405, EHS Criticality Assessment.

A.5 EEMUA

The Engineering Equipment and Materials Users' Association (EEMUA), is a European based, non-profit distributing, industry Association run for the benefit of companies that own or operate industrial facilities.

A.6 KPI

A Key Performance Indicator

A.7 Nuisance Alarm

An alarm or occurrence of an alarm which has no value to the operator and requires no action to be taken.

A.8 Rationalization

A.8.1 Rationalization is a process whereby the efficiency of an alarm system is improved. As such it can be a significant activity. Typical components are:

A.8.1.1 The design of the plant alarms is checked against the Alarm Design Philosophy.

A.8.1.2 Unnecessary alarms are removed.

A.8.1.3 Nuisance alarms are reduced.

A.8.1.4 Alarm priorities are assigned.

A.8.1.5 Alarm responses and other documentation are prepared.

A.9 Response

The actions an operator must take following the occurrence of an alarm.

A.10 Standing (Stale) Alarm

An alarm which has been in the active state for a period of time (typically a shift).

A.11 Top Ten Alarms

This refers to the ten most frequently occurring alarms in a time period of interest. The time period would normally match the review period for which the data is required (a week for the weekly review).

Attachment B: Required Documentation for Alarms

The minimum documentation for an alarm system shall be:

B.1 Alarm Schedule

A list of all alarms on the site shall be documented, as well as the following data for each: tag number, description, priority, set point if applicable, and reason for the alarm.

B.2 EHS Critical Alarm List

A list of EHS critical alarms, as defined in Attachment A. This can be incorporated into the Alarm Schedule or be part of the safety trip system schedule or be a separate document at the Alarm Management Leader's discretion.

B.3 Alarm Responses

The expected response to an alarm by the operator shall be documented for EHS critical alarms (mandatory) and is good practice for other alarms. (See IVL EHS-412, Operating Procedures (to be issued at a future date)).

B.4 Alarm Design Philosophy

This document gives the detailed design requirements of the alarm system and individual alarms. It is described in more detail in Attachment C.

B.5 Disabled Alarm Logs

A list of disabled alarms shall be available to the operators and their Line Managers.

Attachment C: Alarm Design Philosophy

C.1 The Alarm Design Philosophy is an essential document to ensure that the alarm system is maintained in a consistent state, is consistent with objectives of the site and to enable any new projects to be engineered to the same consistent standard.

C.2 It should include the following topics:

C.2.1 Allocation of roles and responsibilities for design of the alarm system including user involvement.

C.2.2 Identification of the alarm system users and their needs.

C.2.3 A definition of alarms as they apply to the operation.

C.2.4 A definition of the safety role of the alarm system.

C.2.5 Rules for the management of any alarms in which a risk reduction factor (RRF) credit has been taken in a SIL Target Assessment (see IVL EHS-406, IPL/SIL Assessment Methodology).

C.2.6 Definitions of alarm system performance targets (e.g., maximum rates).

C.2.7 Rules for prioritization (see guidelines in Attachment D), testing and maintenance of alarms.

C.2.8 Checklist for designers on the information to be recorded for each alarm.

C.2.9 Convention of terms and abbreviations to be used in alarm messages.

C.2.10 Guidance to contractors on the design of alarms (where appropriate).

C.2.11 Guidance on content and structure of alarm response procedures.

C.2.12 Guidance on interpreting patterns of alarms, and their grouping, masking and acceptance (where appropriate).

C.2.13 Information on how to calculate alarm test frequencies.

C.2.14 Detailed requirements of the items above are described in EEMUA 191 section 2.

Attachment D: Guidelines for Alarm Prioritization

The following are guidelines for the prioritization of alarms.

D.1 Good prioritization of alarms is vital for the efficient operation of a process.

D.2 The priority of an alarm should be determined by 1) the operator response time required to mitigate the problem, and 2) the consequences of not responding to the alarm.

D.3 Three levels of prioritization are recommended with a possible fourth for emergency conditions, e.g., these priority levels could be named Emergency, High, Medium, and Low.

D.4 Note: Indorama Ventures does not recommend the use of the emergency priority. Such conditions would potentially be managed with a Safety Instrumented Function (SIF) (see IVL EHS-409, Design and Maintenance of Safety Instrumented Functions). If emergency priority is used for an alarm, very clear definitions for its use need to exist; it would generally be used to warn of a hazardous event which is in progress and requires immediate action to mitigate the consequences.

D.5 The distribution of these alarms should be roughly as follows:

Emergency	Only a few, <20*
High	About 5% of total
Medium	About 15% of total
Low	About 80% of total

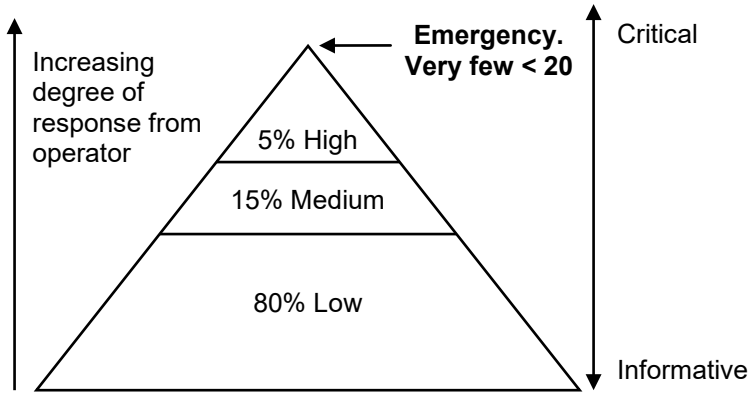
* This number is based on large plants with >1000 alarms.

D.6 Ideally the above distribution should refer to the occurrences of alarms, i.e., the number of alarms presented to the operator. However, in the early stages of a project this information is not available, and it can only be applied to the number of alarms configured.

D.7 Also, these figures are a guide only. Specific plant circumstances may distort the achievable distribution.

D.8 High, Medium, and Low alarms are typically engineered in the main control system (e.g., Distributed Control System [DCS] or Programmable Logic Controller [PLC]). Emergency alarms are on occasion engineered in a separate, sometimes hardwired system. Often there are no emergency alarms.

Figure 1 PRIORITY DISTRIBUTION



D.9 There are various methods for allocating a priority to an alarm including:

D.9.1 Applying a risk matrix approach (see below).

D.9.2 A review of all alarms by a team of competent persons with plant experience and applying a simple ranking.

D.9.3 Allocating priorities by type of alarm.

D.10 However, the principal criteria are the consequence of not responding to the alarm and the time available for the operator to respond.

D.11 The alarm priority matrix below gives a means of prioritizing alarms based on consequence and time to respond. It is offered as a guide only and requires tailoring to a site's specific features.

D.12 For safety and environmental factors IVL EHS-208, Risk Management Standard and Matrix, can be used to provide the definition of the consequence.

Figure 2 ALARM PRIORITY MATRIX

	Consequence		
Urgency of Operator Response	**IVL EHS-208 Severity Category H**	**IVL EHS-208 Severity Category G**	**IVL EHS-208 Severity Category F thru A**
> 10 min	**Priority "Low"**	**Priority "Low"**	**Priority "Medium"**
2 - 10 min	**Priority "Low"**	**Priority "Medium"**	**Priority "High"**
< 2 min	**Priority "Medium"**	**Priority "High"**	**Priority "High"**

Any alarm that falls into one of the Priority "High" boxes is a strong candidate for using a SIF rather than an operator response to an alarm (see IVL EHS-409, Design and Maintenance of Safety Instrumented Functions). A credit can only be taken, in a SIL Target Assessment (see IVL EHS-406, IPL/SIL Assessment Methodology), for operator response to an alarm if there is greater than 10 minutes to respond predicated that the time to detect, diagnose, and respond to the alarm can be validated to ensure the process can be brought to a safe state.

D.13 Other matrices and methods are described in Appendix 5 of EEMUA 191, Alarm Systems, A Guide to Design, Management and Procurement.

Attachment E: Key Performance Indicators

The following paragraphs describe typical Key Performance Indicators (KPIs) which give a useful indication of alarm system performance. The Alarm Management Leader(s) may choose which are the best to use for the particular site. The average alarm rate and peak alarm rate are measures which shall always be monitored.

Some KPIs are based on the number of occurrences per operator. Some judgement must be exercised where there are multiple operators. It is only valid to divide the number of occurrences by the number of operators if the alarm load is distributed evenly and if the operators do not each have to review and interpret the same alarm messages. Likewise, if one operator is routinely absent, then this must be taken into consideration.

E.1 Average Alarm Rate

E.1.1 This is the average number of alarms in a ten-minute period over the overall time period in question (e.g., a month). It is intended to give a measure of the load on the operators during normal operation. As such if there are 10-minute periods of unusually high alarm load, these periods could be ignored. Provided there are only a few such periods, it is generally easier to take a simple average of all the data. Periods where the site is shutdown clearly should be excluded from this analysis.

E.1.2 The accepted guideline[1] is <1 alarm per 10-minute period per operator.

E.2 Peak Alarm Rate

E.2.1 This shows the highest rate of alarms to which the operator is subjected, usually during upset conditions. It is calculated by taking the 10-minute period with the highest number of alarms.

E.2.2 The accepted guideline[1] is <10 alarms per operator in 10 minutes in the period following an upset.

E.3 Number of Disabled Alarms

E.3.1 This is simply the number of alarms which are disabled in any way at a certain time.

E.3.2 The accepted guideline[1] is <30 disabled alarms. (This is based on a large plant with >1000 alarms).

E.3.3 This count does not include alarms automatically disabled as part of normal operation, for example, at a certain stage in a batch process.

E.4 Number of Standing (Stale) Alarms

E.4.1 The number of alarms which have been in the alarm state for more than one shift.

E.4.2 The accepted guideline[1] is <10 standing alarms. (This is based on a large plant with >1000 alarms).

E.5 Time Outside of Guidelines

E.5.1 This is the number of time periods with an alarm rate in excess of the average alarm rate target as a percentage of the total number of time periods.

E.5.2 The accepted guideline[1] is <25 percent.

[1] Based on EEMUA Guide 191, Edition 2

E.6 Priority Distribution

E.6.1 This is the percentage of occurring alarms of each priority during a particular period.

E.6.2 Guidelines are given in Attachment D. Also see EEMUA guidelines (Reference7.8)

Attachment F: Alarm Review Process

A system of alarm reviews is essential to maintaining the ongoing performance of the site's alarm system.

F.1 Initial Alarm Review

An initial alarm review is required to give a baseline with which to compare the future performance of the alarm system. This step is intended to establish the current Key Performance Indicators (KPIs), the state of the documentation and the usefulness of the alarm system to the operators before any rationalization or improvement process is implemented.

F.2 Nuisance Alarm Review

F.2.1 The worst performing alarms shall be identified on a routine basis. This review shall be between representatives from the Distributed Control System (DCS) Team, the Instrument Maintenance Team, and the Operations (production) Team.

F.2.2 Remedial action shall be taken on the basis of this review to gradually improve the average alarm rate.

F.2.3 This is an informal review and its frequency can be varied depending upon the severity of the site's alarm problems. For facilities with excessively high nuisance alarm rates the review shall be weekly or more frequently.

F.3 Monthly Review

On a monthly basis, the Operational Review Team shall review the alarm Key Performance Indicators (KPIs) to monitor the alarm system performance and demonstrate management commitment to the process.

F.4 Annual Review

On an annual basis, the Alarm Management Leader(s) and the Site Head shall review the alarm system KPIs of the previous year. If remedial action is required, then this shall be initiated. Targets for the next year shall be set at this review.

F.5 Quarterly Review

If the alarm system performance is significantly worse than the performance targets, then the Site Head and the Alarm Management Leader(s) shall hold more frequent reviews. These may be targeted at certain areas of the site with poor performance if necessary.

F.6 Local Compliance Audit

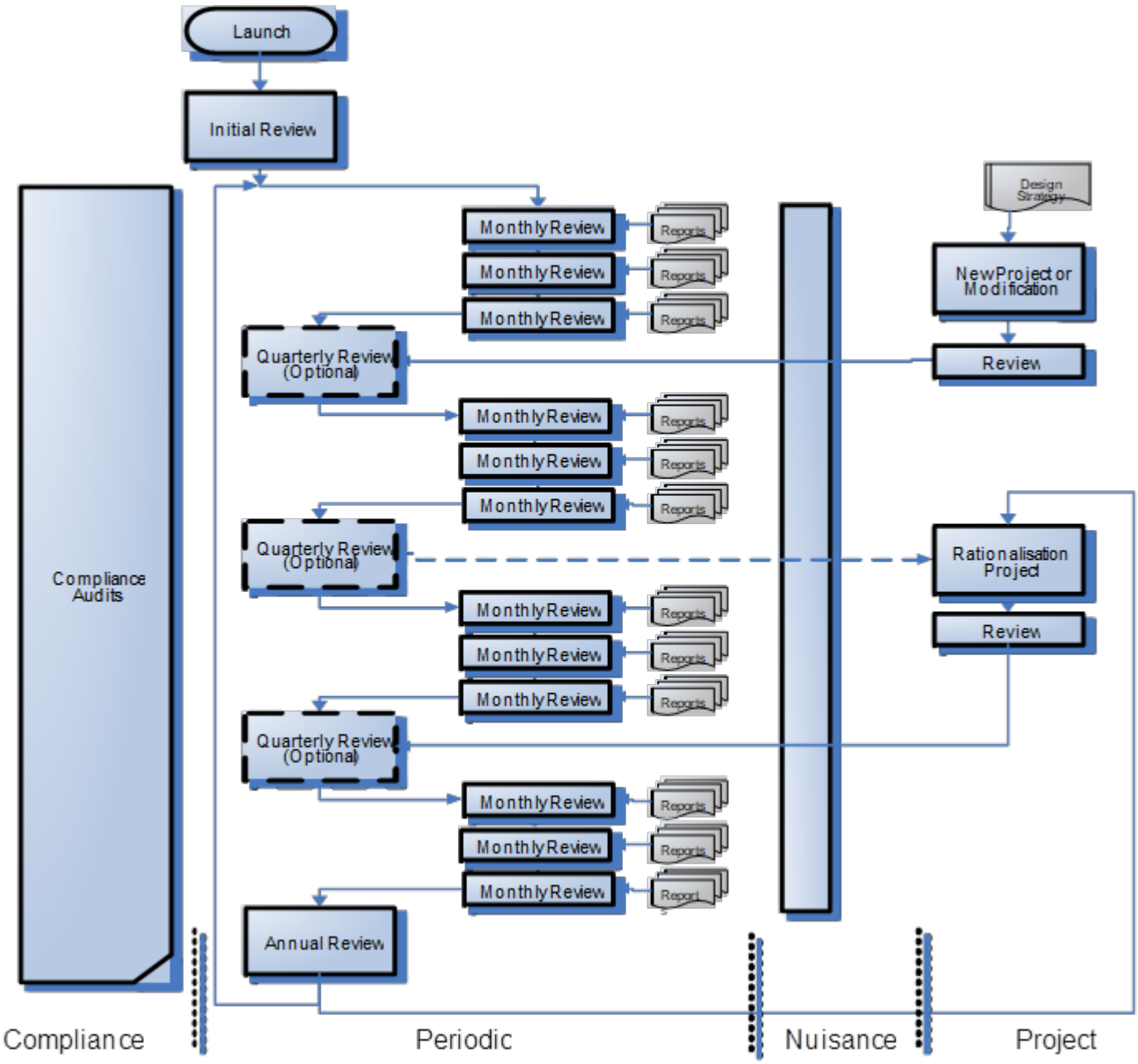
F.6.1 Once a complete set of procedures and supporting documentation has been established, and the operation of the system is stable, compliance shall be tested annually as a minimum. The period may be varied to link with local QA requirements or to comply with local regulatory requirements.

F.6.2 The local compliance audit will highlight areas where the procedures are not being adhered to with sufficient diligence or where the procedures themselves are lacking in some way. It shall demonstrate a level of management commitment to the alarm system and its operation.

F.6.3 In addition, a local procedure shall require an annual audit to demonstrate that the alarm settings meet those specified by the alarm documentation.

F.6.4 The compliance audit review process is shown graphically in Figure 3.

Figure 3 FINAL COMPLIANCE AUDIT REVIEW PROCESS



Attachment G: Remedial Actions

The table below gives some guidance on the types of remedial action which can be employed.

Problem	Possible Action
High Nuisance Alarm Rate	Keep reviewing “Top 10” alarm list and remediate as necessary
	Maintain instruments
	Review set points
	Apply hysteresis or time delays as appropriate
	Redesign the alarm installation
	Re-evaluate the process design
High Peak Alarm Rate	Consider grouping or eclipsing
	Use priorities to filter alarms
	Confirm that all alarms are necessary
High Standing Alarms	Review individually
	Consider shelving
	Hide alarms from shut down equipment
Severe Exceeding of Key Performance Indicator (KPI) Targets	Consider targeted alarm rationalization project

Attachment H: Training Requirements for Alarms

H.1 Operator Training Requirements

H.1.1 General training requirements are covered by IVL EHS-412, Operating Procedures (to be issued at a future date).

H.1.2 It is expected that the operator has a good understanding of the process; the training is expected to cover how to diagnose the cause of a problem and take the appropriate action.

H.1.3 In order to make efficient use of the alarm system, the operators must be trained and competent on:

H.1.3.1 The design intent (given by the Alarm Design Philosophy /Alarm Design Strategy).

H.1.3.2 The features of the Distributed Control System (DCS) alarm system.

H.1.4 This is of particular importance when they are required to cope with several alarms simultaneously and during periods of high alarm load.

H.1.5 Prioritization and Diagnosis Skills

H.1.5.1 Training for operators in this area shall include:

a. the basic philosophy of prioritization,
b. the prioritization strategy adopted for their specific site.

H.1.6 Operation of the Alarm System

H.1.6.1 Clearly, a prerequisite to effective alarm management is the operation of the alarm system correctly and effectively.

H.1.6.2 Training on the displaying of alarms shall include:

a. color and other display conventions,
b. navigation of the system,
c. use of summary and other alarm management displays,
d. management of the alarm (acceptance, silencing), and
e. filtering by priority or other criterion.

H.1.7 Corrective action

H.1.7.1 The operator shall know how to play his/her part in the alarm management process, in particular:

a. reporting nuisance alarms according to local procedure,
b. using the disabling procedure effectively,
c. communicating information about alarms between shifts, and
d. recognizing faults in the alarm system itself.

H.2 Training of Engineering and Maintenance Personnel

H.2.1 In order to ensure that the initial system design and any modifications are carried out in line with the Alarm Design Philosophy, training of maintenance, engineering and project personnel is required.

H.2.2 Training shall also be provided in the operation and applicability of the change control system as it applies to alarms. In particular, the assessment and recognition of safety related modifications must be addressed.

H.2.3 Note that it may also be necessary to train contractors or equipment vendors involved in the design, implementation, or modification of the alarm system.

H.2.4 Maintenance personnel are likely to be exposed to nuisance alarms as many of these are caused by instrument and other equipment faults. Training shall be provided in the system of nuisance alarm management.

H.3 Revision and Refresher Training

Operations and other personnel will perform some tasks associated with alarm management routinely. In this case, it is expected that the initial formal training will be reinforced by practice and experience. Other tasks, particularly exposure to critical and complex alarm situations, will not be experienced on a routine basis and the benefits of formal training are likely to be eroded by time. In this case refresher training is beneficial. Refresher training shall be provided once every three years, or more frequently as needed, refer to IVL EHS-412, Operating Procedures (to be issued at a future date).

H.4 Validation of Training

H.4.1 Training shall be formally validated and recorded.

H.4.2 Observations shall also be made while the operators are using the workstations to check that they are making effective use of the facilities available. This is probably best done by the operator’s supervisor.

H.5 Training Following Change

H.5.1 Training of operations and other personnel shall be conducted when changes to the system are undertaken. This includes changes to the wider procedural environment.

H.5.2 Appropriate training must be given to personnel joining the operations or the engineering team or moving roles within that team.

H.5.3 These changes will be managed in accordance with IVL EHS-204, Management of Change and/or IVL EHS-104, Organizational Change Management.