SAFETY AUDIT / ASSESSMENT TOOL
INDUSTRIAL GAS AND LIQUID PLANT

Doc 102.05/22

Revision of Doc 102/08 Appendix C4

EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL

AVENUE DE L'ASTRONOMIE 30 • B – 1210 BRUSSELS

Tel: +32 2 217 70 98

E-mail: info@eiga.eu • Internet: www.eiga.eu

Doc 102.05/22

SAFETY AUDIT / ASSESSMENT TOOL INDUSTRIAL GAS AND LIQUID PLANT

Prepared by WG-16 Worker Safety and WG-3 Process Equipment

Disclaimer

EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL
Avenue de l'Astronomie 30 B 1210 Brussels Tel +32 2 217 70 98
E-mail: info@eiga.eu Internet: www.eiga.eu

Table of Contents

Amendments to Doc 102/08

All	Revision of Doc.102/08 Appendix C4
All	New format of Safety Audit / Assessment Tool

1 Introduction

Auditing is a proactive management tool for use by an organisation or activity as a part of its management responsibilities. It is used to proactively confirm compliance, detect potential issues and facilitate future improvement

EIGA Doc. 102 *Audit Guidelines* provides an overview of audit and self-assessment processes, identifies different types of audits and lists the key points for ensuring success.

Sections 8.2 and 8.4 of Doc. 102 refers to EIGA's audit tools document series that can be used in verification of findings and evidence collection and in action plans and follow up to audits.

This publication is part of that series.

2 Scope and purpose

2.1 Scope

This publication provides a checklist focusing on a specific area of safety, health and environment, management systems and technical practices within the industrial and medical gas industry.

This checklist does not incorporate all the requirements of local or national legislation. These should be taken into consideration when planning any audit or developing audit checklists.

The tool or combination of tools used can depend upon the type of audit and the organisation, location or site characteristics.

2.2 Purpose

Each Safety Audit / Assessment tool contains a list of questions that may be used by the auditor in the format shown in 3.1. Each question has a sequential reference number, the question itself and where relevant a reference to the EIGA publication or external publication that provides guidance on that specific topic.

These question sets may then be used at different stages of the audit process, by combining them with additional information columns in a manual or automated audit system, depending on company systems.

Section 3.2 shows the format of how the question set may be used for collection of evidence and development of findings.

Section 3.3 shows the format of how the question set may be used for management of actions arising from the audit.

Forms may be adapted or combined depending on audit and action monitoring systems used by a company.

The Auditor should not ask the questions on this list in isolation but should read them in conjunction with EIGA Doc 102 and the referenced technical document.

3 Formats for Audit Checklists

3.1 Format for Audit / Assessment Tool Questions

Question reference	Question	Document Section Reference
Use sequential numbering system within each section. E.g. 1.2, 1.3. *Try to avoid multiple clustered questions under the same number, but describe them as separate questions.*		*In EIGA reference document or external reference document*

3.2 Typical Format for collection of evidence and development of findings

Question reference	Question	Document Section Reference	Yes No N/A	Description of Evidence / Comments *(Ref…)*	Findings *(Ref…)*	Recommendations for improvement *(Ref Doc xxx 8.2.6*	Action Required Yes/No
Use sequential numbering system within each section. E.g. 1.2, 1.3. *Try to avoid multiple clustered questions under the same number, but word them as separate questions.*		*In EIGA reference document or external reference document*	*Answer is yes or no or question is not applicable*				

3.3 Typical format for management of actions arising from the audit

Question reference	Findings	Action(s)	By Whom	Dates	
				Target	Complete
Use sequential numbering system within each section. E.g. 1.2, 1.3. *Try to avoid multiple clustered questions under the same number, but word them as separate questions.*					

4 Industrial Gas and Liquid Plant – Question Set

1 General safety
2 Main air compressor and surrounding area
3 Air refrigeration equipment
4 Air condensate separators/molecular sieves/switch valves
5 Cold box and surrounding area
6 ASU
7 Control room
8 Avoidance of hydrocarbon concentration
9 Oxygen pumps
10 Expansion turbines
11 Argon and nitrogen compressors
12 Oxygen compressors
13 Cooling towers
14 Cooling water treatment
15 Emergency equipment/procedures
16 Argon purification plant
17 Hydrogen system
18 Product and disposal vaporisers for liquid nitrogen, oxygen and argon

Note This questionnaire is not exhaustive and may need to be complemented/adapted in order to cover all the procedures, plant and equipment on site.

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
1.0	**General/Safety**								
1.1	Is the standard of housekeeping adequate								
1.2	Is there safety reference literature available on site on the following material categories: acetylene/acetylides ammonia freon argon chloride/chlorine hydrogen nitrogen oxygen miscellaneous gases (eg NO, NO_2, F, HF, H_2S								
1.3	Is an approved procedure in use for authorising modifications of plant and process control circuits etc								
1.4	Are electrical personnel certificated/ authorised to carry out work related to high, medium and low voltage equipment								
1.5	Is there a program covering mechanical integrity								
1.6	Is a lock out/tag out procedure in place								
1.7	Is a permit to work procedure in place								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
1.8.1	Are operating procedures issued for all plant and equipment								
1.8.2	Are all operating procedures kept up-to-date								
1.9.1	Are cleaning specifications and acceptance standards for production plants clearly defined								
1.9.2	Do these cleaning specifications differentiate between the requirements for: gases air liquid air/enriched air oxygen clean etc								
1.10	Is an authorised material list available for oxygen service which is used when replacing joints, sealing rings and component parts								
1.11	Are pressure gauges for oxygen service clearly identified								
1.12	Is a process in place to address coldbox leaks, like root cause analysis, mitigation, risk assessment.								
1.13	Are there written emergency procedures in place relating to a large liquid spill from a tank, tanker or container								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
1.14	Are maximum periods between air separation unit thawings defined and followed								
1.15	Are plant pressure systems, condensate separators and carbon steel pipework adequately inspected (for corrosion/erosion etc) and proper records kept								
1.16	Is a management system of change in place for additions, revisions or modifications to computer hardware/software								
1.17	Are rules established for inspection and pressure testing of relief valves (refer to IGC Doc 24/83)								
1.18.1	Are consolidated rules laid down for inspection and maintenance of gas transmission lines (internal to factory and external to customers) (see DOC 235/21)								
1.18.2	Do these rules cover: pipeline surveillance pipeline repairs pipeline reporting periodic checks cathodic protection monitoring								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
1.19	Are adequate flow sheet/drawings available for all plant and ancillary services/equipment, eg instrument air, seal gas, cooling water etc								
1.20	Are personal atmospheric monitors available, if prescribed by site regulation								
1.21	Are visual alarms well visible from relevant positions								
2.0	**Main Air Compressor & Surrounding Area**								
2.1	Is the sign 'Entry Permit Required' mounted on the air inlet duct inspection door/filter house door								
2.2	Is the floor grating surrounding the compressor securely mounted on supports								
2.3	Is the area free of tripping/slipping hazards								
2.4	Are appropriate guards fitted over machine couplings								
2.5	Are noise warning signs posted in appropriate areas								
2.6	Is the sign 'Danger – Do Not Stand in Front of Cabinet While Motor is being Started' mounted on starter capacitor box								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
2.7	Is the emergency stop button functionally tested at regular intervals								
2.8	Are operating instructions available								
2.9	Are intercooler/aftercooler vents, drains and bursting discs piped to a safe location								
2.10	Are alarms and trip values defined and implemented								
2.11	Is there a preventative maintenance system in use for regular inspection/calibration of: pressure gauges all instrumentation alarm/trip functions temperature indicators major machine components filters and valves electrical motors electrical systems safety devices vibration monitors etc								
2.12	Is technical data provided by compressor manufacturer available								
2.13	Are relevant process data logged								
2.14	Is a system in place to check the recorded data								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
2.15	Is a system in place to check for unusual events								
2.16	Is alarm/trip function provided on compressor discharge regularly tested								
2.17	Is the instrumentation of the anti-surge protection of the turbo compressor regularly calibrated								
2.18	Are inter-cooler and after-cooler vessels internally inspected at regular intervals								
2.19	Are drain valves fitted to the bottom of each cooler and (if existing) water traps tested at regular intervals								
2.20	Is the instrumentation of the guide vanes of the compressor checked at regular intervals								
2.21	Is the vibration instrumentation functioning and working properly								
2.22.1	Is the type of lubricating oil used in accordance with company recommendations								
2.22.2	Is the procedure for blowing oil separator drains being properly followed								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
2.23	Are records of approach temperatures to coolers of compressors kept								
2.24	For reciprocating compressors: are piston and ring clearances checked at regular intervals								
2.25	Are instrumentation and alarm/trip functions in working order on oil filter units								
3.0	**Mechanical Chiller Equipment**								
3.1	Ammonia								
3.2.1	With ammonia cycles, are warning signs posted forbidding entry in the event of leakage unless proper procedures have been followed (use of breathing equipment etc)								
3.2.2	Is there an emergency procedure in place in case of a major leak of ammonia								
3.2.3	Are operating instructions in place								
3.2.4	Are special procedures in place identifying the means of isolating/ replenishing/recommissioning the ammonia sections								
3.2.5	Are personnel aware of the danger of ammonia leaking into the plant process stream								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
3.2.6	Are emergency showers/eye washes sited adjacent to ammonia refrigeration equipment								
4.0	**Air Condensate Separators/ Molecular Sieves/Switch Valves**								
4.1	Are condensate drain valves checked regularly for proper operation								
4.2	For totally enclosed rooms:								
4.2.1	Do all exit doors open outward								
4.2.2	Is powered ventilation with louvres in working order								
4.2.3	Is a visual alarm for oxygen deficiency at the entrance doors								
4.2.4	Does oxygen monitor give audible/ visible alarm in the event of increase/decrease in oxygen concentration								
4.2.5	Are ‘Danger’ signs posted at all doorways								
4.2.6	Are all nitrogen vent sources piped to a safe outside location								
4.3	Are guards installed over switch valve mechanisms								
4.4	Are lubricants applied to the switch valves oxygen compatible								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
4.5	Is the high temperature instrumentation on the air stream from the molecular sieve to the cold box tested and calibrated at stipulated intervals								
5.0	**Cold Box and Surrounding Area**								
5.1	Are coloured caps fitted over the ends of protruding valve spindles								
5.2	Is cold box pressure regularly logged								
5.3	In the event of abnormal ice patches:								
5.3.1	Are gas samples taken from frost spot areas and analysed								
5.3.2	Is appropriate action taken								
5.3.3	Are leaks reported to management and possible consequences evaluated								
5.4.1	Do safety valve exhausts vent to a safe place								
5.4.2	Are these vents free from obstruction								
5.5.1	Do liquid drain lines slop downhill into the disposal header								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
5.5.2	Are there any low points where total evaporation of LOX could lead to a dangerous hydrocarbon concentration. If yes, do they get regularly drained.								
5.6	Following a deriming operation, are procedures followed (preferably logged) to ensure that all drain and instrument lines are clear and free from moisture								
5.7	Are signs 'Possible Asphyxiation/ Enrichment of Atmosphere Beyond this Point' installed for walkways and platforms in the risk area of argon, nitrogen and oxygen vents								
5.8.1	Is insulation material used on cold piping in good order and dry								
5.8.2	If not, are atmospheric conditions leading to pipe corrosion								
5.9	Is there any evidence of valve spindles rubbing on the panel								
5.10	Is the area free of tripping/slipping hazards								
5.11	Do ladders, cages, safety gates, handrails and platforms comply with legal/company standards								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
5.12	For plants equipped with a deoxo unit: is there the ability to check for hydrogen levels in the the cold box casing in case of leaks								
6.0	**ASU**								
6.1	Are process and instrumentation diagrams up to date for the whole process.								
6.2	Are adequate operating instructions available								
6.3	Do they include:								
6.3.1	Start-up procedures								
6.3.2	Normal operation								
6.3.3	Shut-down procedure								
6.3.4	Thawing procedure								
6.3.5	Emergency shut-down procedure								
6.3.6	Emergency liquid disposal procedure								
6.4	Are relevant process data logged								
6.5	Is a system in place to check the recorded data								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
6.6	Is a system in place to check for unusual events								
6.7	Are all liquid level instrumentation, alarms/trips on columns or condensers checked and maintained at stipulated intervals								
6.8	Are purity alarm/trip functions tested regularly – particularly with respect to oxygen content								
7.0	**Control Room**								
7.1	Do doors open outward								
7.2.1	Are analysers vented to a common vent header and piped outside the building								
7.2.2	Is hydrogen vented through a separate header								
7.3	Are all chemicals used for analysis clearly identified and is SDS available								
7.4	Is oxygen monitoring carried out in the control room if high or low oxygen concentration can occur								
7.5	Is the oxygen monitor tied in with an audible alarm								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
7.6	Are all cylinders properly secured to prevent them from falling								
7.7	Does the use and location of cylinders meet the requirements of company and national regulations								
7.8	Can the wind direction be identified from the control room if necessary?								
7.9	Are non-smoking areas clearly defined								
7.10	Are suitable fire extinguishers available								
8.0	**Avoidance of Hydrocarbon Concentration**								
8.1	Are reactivation procedures established for hydrocarbon/ acetylene adsorbers								
8.2	Is there a constant monitoring of hydrocarbons within the LP column sump/reboiler condenser, if necessary								
8.3.1	Is a system in place to check and follow up hydrocarbon levels in the liquid oxygen pool above maximum permitted								
8.3.2	Are procedures established and followed in case of a significant increase in hydrocarbon level being detected								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
8.4	Are checks for hydrocarbons within LOX reboilers regularly carried out (acc DOC 65)								
8.5.1	Is liquid level in oxygen reboiler bath always maintained at a safe operating level and not below minimum level.								
8.5.2	Is a LOX purge being maintained from oxygen/enriched bottom column that is sufficient to ensure hydrocarbon concentration does not exceed safe levels (see DOC 65)								
9.0	**Oxygen Pumps**								
9.1	Are operating instructions in place								
9.2	Verify adequate seal gas supply to pumps , if seal gas is needed								
9.3	Is control equipment for seal gas checked and maintained regularly, eg regulators, valves etc								
9.4	Is there a preventive maintenance system for inspection/calibration of:								
9.4.1	Vibration monitoring devices								
9.4.2	Mechanical pump components (labyrinth, filters etc)								
9.4.3	Alarm/trip related instrumentation								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
9.4.4	Safety devices, eg under-current/ over-current etc								
9.4.5	Electric motors								
9.4.6	Electrical systems								
9.5	Are oxygen cleanliness related procedures in place. (DOC 33)								
9.6	Are the manufacturers' and company regulations regarding lubrication of pumps and motors strictly observed.								
9.7	Are pump suction filters checked and cleaned at regular intervals								
9.8	Are centrifugal pumps free from materials non-compatible with LOX, eg aluminium alloy – see IGC Doc 148								
9.9	Is centrifugal pump cavitation protection maintained in good condition and tested, eg pressure switches, low current trip								
9.10	If pumps are installed in confined spaces, are ventilation openings free from obstruction								
9.11	Is the area around the pumps free from combustible material, eg oil, grease, tar etc								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
10.0	**Expansion Turbines**								
10.1	Is manufacturer's data on these machines available								
10.2	Are operating instructions in place								
10.3.1	Are all applicable pressure, temperatures and power figures being monitored and logged								
10.3.2	Are pressure and temperature conditions at the turbine exhaust controlled so as to avoid any possibility of liquid formation in turbines								
10.4.1	Are the alarm/trip functions of the brake generator tested at regular intervals								
10.4.2	Is alarm/trip system of the vibration monitor regularly tested								
10.4.3	Are alarm/trip functions provided for oil temperature, oil pressure and oil tank level tested regularly								
10.5	Are alarm/trip functions for seal gas pressure tested regularly								
10.6	Is the overspeed trip device tested regularly								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
10.7	When carrying out maintenance of turbines, are cleanliness standards strictly observed								
11.0	**Argon & Nitrogen Compressors**								
11.1	For machinery enclosures:								
11.1.1	Do all exit doors open outward								
11.1.2	If powered ventilation with louvres is used, is it in working order								
11.1.3	In case of atmospheric air monitoring, is there a visual alarm for oxygen deficiency at entrance doors								
11.1.4	Does oxygen monitor give an audible/visual alarm in the event of reduced oxygen concentration								
11.1.5	Are danger signs posted outside all entrances to this enclosure: 'Caution Oxygen Deficiency Possible'								
11.1.6	Are all argon and nitrogen vents piped to a safe outside location								
11.2	Is the grating around the compressor area securely mounted								
11.3	Is sign 'Danger – do not Stand in Front of Cabinet While Motor is being Started' mounted on starter capacitor box								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
11.4	Are bursting disc and relief valve discharges piped to a safe area								
11.5	Is emergency stop button functionally tested at regular intervals								
11.6	Are operating instructions in place								
11.7	Are warning signs posted near hot piping/intercoolers.								
11.8	Is compressor manufacturer's technical data available								
11.9	Are relevant process data logged?								
11.10	Is a system in place to check the recorded data?								
11.11	Is a system in place to check the unusual events?								
11.12	Is alarm/trip system provided on compressor discharge tested regularly								
11.13	Is the instrumentation of the anti-surge protection of the turbo compressor regularly calibrated								
11.14	Are cooler purging procedures available								
11.15	Are alarm/trip functions on oil filter units working properly								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
11.16	Are the compressors being regularly maintained in accordance with the preventative maintenance system								
12	**Oxygen Compressors See IGC Docs 10 & 27**								
12.1.1	Is entry to an oxygen compressor machinery space forbidden by specific instruction whilst the compressor is in oxygen service								
12.1.2	Can all necessary instrument readings be taken from a safe place or remotely transmitted to a safe place								
12.2	Do entrance and exits to restricted areas have appropriate warning signs								
12.3	Are specific operating procedures available								
12.4	Are emergency stop buttons available and regularly tested								
12.5.1	Are all vent, drain and relief valves etc piped to external safe locations								
12.5.2	Is the position of the oil vapour vent at a safe distance from all the above oxygen vents								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
12.6	Is the sign 'Danger – Do not Stand in Front of Cabinet while Motor is being Started' mounted on starter capacitor box								
12.7	In case there is no oil low level alarm, is the area frequently checked for oil spillage								
12.8	Is the piston rod checked for any sign of oil contamination after shutdown.								
12.9	Are EIGA recommendations regarding start-up/shut down followed, e.g. use of inert gas or defined procedure.								
12.10	Are alarms and trip values defined and implemented								
12.11	Is compressor manufacturer's technical data available								
12.12	Are relevant process data logged								
12.13	Is a system in place to check the recorded data								
12.14	Is a system in place to check for unusual events								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
12.15	Have procedures been established for the inspection and maintenance of oxygen machinery and do they cover:								
12.15.1	Compressor isolation/purging								
12.15.2	The use of oxygen compatible materials								
12.15.3	Oxygen cleanliness standards and cleanliness inspection								
12.15.4	Purchase of oxygen spares to written cleanliness specifications								
12.15.5	Maintaining spare parts in this clean condition until used and are spare part clearly labelled (e.g. “clean for oxygen service”)								
12.15.6	Carrying out pre-filter and non-return valve inspection whenever regular compressor maintenance is done								
12.16	Are non-return valves installed in oxygen compressor discharge pipelines								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
12.17	Are manually operated valves, which could be subjected to high flow oxygen, provided with protection shield in order to protect personnel in the event of an ignition during valve operation.								
12.18	Is start up of turbo compressor linked to the availability of a 'failsafe' seal gas control system								
12.19	Are warning signs and fire fighting equipment installed in accordance with the site emergency plan								
12.20	Are personnel provided with protective clothing and equipment for their full range of activities, including the risk of working in oxygen enriched-atmosphere								
12.21	Is there a planned preventive maintenance system in existence for the frequent inspection/ calibration of pressure gauges, temperature indicators, vibration monitoring equipment, major machine components, all instrumentation, filters, valves, relief valves, alarms, trips, electric motors, electrical systems, safety devices including seal gas equipment								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
12.22	In the event of a trip, is a 'first flag' indication available to simplify fault diagnosis								
12.23	Are individual compressors fitted with alarms/trips initiated by low cooling water flow conditions and/or high gas temperatures								
13.0	**Cooling Towers & Pumps**								
13.1	Are there guards installed over cooling pump/ fan motor shaft couplings/belt transmission								
13.2	Is the necessary lifting tackle etc available for removal of filter screens before the pump suction								
13.3	Is there adequate protection to prevent personnel falling into cooling tower ponds								
13.4	Is the cooling tower pond fitted with a low level alarm								
13.5	Is the cooling tower deck equipped with kick-boards and non-slip surfaces								
13.6	Are handrails and ladders smooth and free of splinters on wooden towers and free of sharp edges on metal towers								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
13.7.1	When working on gearboxes, vee-belt drives etc on cooling towers, is a 'safe system of work' established for normal operation, inspection and maintenance								
13.7.2	Does this take account of the need to secure the fan blade whilst carrying out maintenance in this area								
13.8	Is an escape route on wooden towers from the top deck available and free from obstruction								
13.9	Are there emergency stop buttons located on top of wooden tower								
13.10	Notwithstanding the use of Permit to Work system when carrying out maintenance, in the event of burning/hot work, then are precautions taken to prevent any sparks/hot metal coming into contact with wooden/combustible materials of construction								
14.0	**Cooling Water Treatment**								
14.1	Are operating procedures established for use of sulphuric acid/caustic/chlorine and any other chemicals and Safety Data Sheets (SDS) available								
14.2	Is an unloading procedure available								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
14.3	Is individual protection as per SDS made available								
14.4	Are warning signs properly posted								
14.5	Are the chemical fixed tank storage vents located close to ground level and do they spill in a safe area								
14.6	Are there emergency showers and eye-wash stations located within the appropriate safety zones								
14.7	Are dosing pumps equipped with plexiglass shields or adequate protections to avoid risk to workers during operation								
14.8	Are drums located in safe areas								
14.9	Are employees aware of the hazardous nature of all materials used in chemical water treatment								
14.10	Is there a risk assessment for plant damage due to excessive deviation of water quality								
14.11	Internal note; Not pertinent to safety								
15.0	**Emergency Equipment/ Procedures**								
15.1	Are the breathing gas cylinders regularly checked for content,pressure and condition								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
15.2	Is the emergency equipment regularly tested / logged								
15.3	Stretchers/fire fighting suits/ fire blankets: is all the equipment regularly inspected/logged								
15.4	Eye washers/showers: is all the equipment regularly inspected/ logged								
15.5	Emergency lighting: is all equipment regularly tested/logged								
15.6	Portable analysers: is all equipment regularly tested/logged								
15.7	First aid kits: is there a check system to ensure the kits are stocked with the necessary items								
15.8	Are emergency procedures available and up-to-date for shutting down all items of plant. Do they include to notify the off-site personnel in case of an abnormal event, including personnel safety emergency.								
16.0	**Argon Purification Plant**								
16.1	Are there heat protective shields around de-oxo reactor								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
16.2	Is there insulation on hot lines which personnel can come in contact with								
16.3	Is the area free of tripping/slipping hazards								
16.4	Do ladders, cages, safety gates, handrails and platforms comply with the national/company standards								
16.5	Is the automatic protection device on high oxygen content in the feed to the de-oxo unit regularly checked								
16.6	Is the high temperature protection device for the reaction regularly checked								
16.7	Are hydrogen/hydrocarbon analysers sensing the cold box for leaks of flammable gases, checked at regular intervals								
16.8	Do sample stream discharges/vents from product analysers vent to a safe area outside the building								
16.9	Is the forced draft ventilation in analyser rooms checked at regular intervals								
16.10	Is the permanent hydrogen gas monitoring device calibrated/logged at stipulated intervals								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
16.11	Are all equipment earthing points checked regularly and working properly								
16.12	Are condensate traps on condensate separators regularly inspected								
16.13	Can all valves for manual operation easily be reached								
16.14	Are the low flow shutdown devices on all process heaters checked/ maintained at regular intervals								
17.0	**Hydrogen System**								
17.1	Is a flowsheet description of the hydrogen system available								
17.2	Are safety distances clearly identified and observed as company regulations								
17.3	Is the hydrogen storage area clearly identified as non-smoking/ non open flame zone								
17.4	Are adequate guards installed around piping and fill connections near vehicle movement areas effective								
17.5	Are vent lines and safety device outlets free from obstruction and piped to a safe height								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
17.6	Is the ventilation of the hydrogen pressure reduction cabinet adequate								
17.7	Are tools that may be used of an approved type								
17.8	Are hydrogen trailers properly earthed prior to connecting								
17.9	Are earthing resistance readings regularly taken of equipment and systems								
17.10	Is the area around and under the hydrogen installation kept free from weeds, bush and combustible material								
17.11	Are all operating personnel trained on properties of hydrogen gas								
17.12	Are all operating personnel trained in handling hydrogen fires								
17.13	Are operating procedures available								
17.14	Are transfer hoses checked or replaced at regular intervals								
17.15	Are anti-towaway procedures for hydrogen trailers in force								
17.16	Are filters cleaned at regular intervals								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
17.17	Are maintenance procedures established to allow for purging of the system so that air cannot enter the storage system before commencing repair work								
18.0	**Product & Disposal Vaporisers for Liquid Nitrogen, Oxygen & Argon**								
18.1	Are low temperature trip devices on product outlets regularly checked								
18.2	Are all alarm/trip devices regularly functionally tested								
18.3	Are provisions made to mitigate the risk resulting from warm water/steam discharge of the vaporiser device in case of coil rupture								
18.4	Are all operating instructions available								
18.5	Is an up-to-date flowsheet available								
18.6	Are all hot water/steam lines which personnel can come in contact with, insulated for personnel protection								
18.7	Are operating personnel obliged to wear specific personal protective equipment when there is a risk to come in contact with steam.								

	Question	Yes	No	N/A	Comment	Agreed Action	By Whom	Dates	
								Target	Compl
18.8	Is cold piping which personnel can come in contact with, shielded to protect personnel								