

CDF Inerting Alarm Procedure

(This is a Safety Procedure)

This procedure outlines the steps to be taken by the CDF Alarm Coordinator in the event of an Inerting Alarm within the CDF Complex.

Approvals:

(CDF Department Head)

(Date)

(Research Division Head)

(Date)

(Acclerator Division Head)

(Date)

1.0 Controlled Copies of this procedure.

Four controlled copies of this procedure will exist in the following locations:

1. CDF Control Room in the CDF Assembly Building
2. RD / CDF Department Office
3. Research Division Office
4. Accelerator Division Office

In addition, one copy of section 2.0 of this document will be in the CDF Control Room in an operator's aid called " CDF Alarms Response Handbook ".

All other copies will be marked, " INFORMATIONAL COPY ONLY "

2.0 The Procedure.

The CDF Alarm Coordinator defined in the current version of the CDF Conduct of Operation Outline will execute the procedures I-1 through I-2 as required.

Definitions and General Information:

The CDF Central Tracking Chamber (CTC) and the CDF Central Drift Tubes (CDT) use Ethane in a 50/50 mix with Argon. Ethane is flammable in the concentrations of 3.5% to 12.5% in air. Because of the number of feedthroughs at each end of the CTC and CDT, the normal leak rate from these two systems is about 23 standard cubic feet per hour (SCFH).

Since the area is hidden behind the CDF Endplugs, a trapped volume of flammable gas exists in the presence of the high voltage and pre-amplifier power distribution systems. **To ensure no flammable mixtures can occur, the trapped volume is purged with Nitrogen and the gas mixture in the trapped volume is continuously monitored by the CDF Inerting System.**

In oxygen concentrations less than 13%, Ethane is not flammable in any concentration.

The CDF Inerting System consists of the following parts:

- (a) Contained volumes at each end of the CDF Central Tracking Chamber (approximately 55 cubic feet total volume) , isolated from the endplug region by a plastic seal called a "baggy",
- (b) A 1450 SCFH (CTC) + 350 SCFH (CDT) Nitrogen purge system with monitored flow and flow rate trip levels ,
- (b) A set of "sample draw pumps" and gas lines to sample the gas in the contained volume at a rate of about 50 SCFH by extracting gas samples to a monitoring "jug",
- (c) A monitoring "jug" in the CDF Assembly Building first floor Gas Relay Rack area, rack RRG04,
- (d) Two Oxygen concentration monitors (standard ODH type) in the "jug".
Only one Oxygen monitor is part of the alarm system with readout in the Gas Relay Rack area, rack RRG04.
The second monitor is a "hot spare" to be swapped in only on authority of the CDF Gas Systems Engineer (or designee).

- (e) Two Ethane sensors in the "jug" with readouts in Relay Rack #1 in the CDF Cryo area.
- (f) Signs and Sonalerts in the CDF Control Room.

The Oxygen concentration monitors are identical to the ones used in the ODH Alarm system. 0% is the oxygen concentration we desire in the inerting volume. However, since a failure mode of these monitors can result in a 0% reading, air is added to the jug to bring the normal reading up to 5% oxygen. The trip levels for oxygen concentration are then set at 3% and 10%. Below 3% indicates a monitor failure. Above 10% indicates a potentially flammable situation (recall 13% oxygen is required for Ethane to be flammable).

No automatic actions occur for either trip level. This procedure deals with the actions to be taken in case of an oxygen concentration alarm.

Note the spare Oxygen concentration monitor is in place to allow a sensor swap in case the first sensor fails. This swap can be done only with the specific approval of the CDF Gas Systems Engineer (or designee). The failed sensor must be tagged out as "failed". The "hot spare" sensor must be tagged as the "available hot spare". If the second sensor fails, the system must be must be shutdown to replace both sensors -- this action requires approval of the CDF Gas System Engineer (or designee).

The Ethane sensors are the infared type "Astro" heads read out by a Model 310 controller. Unlike the the sensors used elsewhere in the Flammable Gas Alarm system, these two are set to give a "pre-alarm" at 30% of the Lower Explosive Limit (LEL) and a "high level alarm" at 50% LEL. All other Flammable Gas Alarm sensors in the CDF system are set at 7% and 20% LEL. These jug sensors are set higher because higher Ethane levels are typical. With a total leak rate of 23 SCFH and a nitrogen purge rate of 1800 SCFH, 1.3 % Argon / Ethane concentration or 0.65% Ethane concentration is expected. 0.65% Ethane concentration corresponds to about 18% LEL.

Since all Ethane alarms are covered by CDF Procedure -2 "CDF Flammable Gas Alarm Procedure", such alarms are not covered in this Inerting procedure.

However, note that the Inerting Alarm Panel in the CDF Control Room registers alarms for both oxygen levels and Ethane levels, so a dual alarm condition can occur.

The Nitrogen purge system for the CTC is monitored by pressure transducers. Normal operating pressure is 12.7 psig = 1450 SCFH. Trip levels for the Nitrogen purge are set at 5.9 psig = 1000 SCFH for low flow and at 19.0 psig for restricted flow. Both trips cause the same automatic actions as a high level Flammable Gas Alarm. **Again, these alarms are covered in CDF Procedure-2 " CDF Flammable Gas Alarm Procedure".**

CDF INERTING SYSTEM PROCEDURE

IN THE EVENT OF AN INERTING ALARM IN THE CDF COMPLEX, THE CDF ALARM COORDINATOR SHALL:

1. SILENCE THE CONTROL ROOM LOCAL ALARM

The sonalert and silence switch are located in the southwest console in the CDF control room.

Check the north wall alarm panel for a possible dual alarm condition.

Record the sequence of events in the SOD logbook.

2. FOLLOW THE APPROPRIATE INERTING ALARM PROCEDURE:

I-1 for Oxygen less than 3%

I-2 for Oxygen greater than 10%

CDF PROCEDURE I - 1

(Inerting OXYGEN below 3%)

NO AUTOMATIC ACTIONS OCCUR, DO THE FOLLOWING:

- 1. HAVE QUALIFIED PERSONNEL (CRYO OPERATOR OR GAS TECH)
INVESTIGATE THE ALARM FROM RACK RRG04 IN THE GAS RACK
AREA ON THE MAIN FLOOR OF THE CDF ASSEMBLY BUILDING.**

An alarm is valid if the jug oxygen sensor reads below 4.5 %.
(a normal reading is 5%)

IF THE ALARM IS VALID, THEN:

- 2. VERIFY SAMPLE DRAW OPERATION**

Have the Gas Tech go to the monitoring station in Gas Relay racks on the main floor to verify that the sample draw pumps are still operating.

- 3. VERIFY NITROGEN FLOW**

Have the Gas Tech check the inerting nitrogen flow on the 730' gas platform.

The Gas Tech should report

CTC flow approximately 1450 SCFH and

CDT flow approximately 350 SCFH.

Have the Cryo Operator check that the nitrogen supply is normal.

- 4. CHECK ETHANE READINGS**

Have the Gas Tech or Cryo Operator check the Ethane readings for the two sensors in the jug.

Read out is in the Cryo area at Relay Rack #1.

- 5. FORMULATE A CORRECTIVE ACTION PLAN**

Call inerting system experts before acting.

Inform the CDF Operations Manager before acting.

IF THE ALARM IS FALSE, THEN:

- 6. An alarm is false if no sensor is in alarm when checked at Rack RRG04
RESET ALARM, RESUME NORMAL OPERATION.**

Inform the CDF Operations Manager.

CDF PROCEDURE 1 - 2

(Inerting OXYGEN greater than 10%)

NO AUTOMATIC ACTIONS OCCUR, DO THE FOLLOWING:

1. IMMEDIATELY VERIFY NITROGEN FLOW

Send the Gas Tech to check the inerting nitrogen flow on the 730' gas platform.

The Gas Tech should report

CTC flow greater than 1200 SCFH and

CDT flow greater than 250 SCFH.

Have the Cryo Operator check that the nitrogen supply is normal.

An alarm is valid if the nitrogen flow is below normal.

An alarm is valid if the sample draw pumps to the inerting jug are not operating.

2. HAVE QUALIFIED PERSONNEL (CRYO OPERATOR OR GAS TECH) INVESTIGATE THE ALARM FROM RACK RRG04 IN THE GAS RACK AREA ON THE MAIN FLOOR OF THE CDF ASSEMBLY BUILDING.

An alarm is valid if the jug oxygen sensor reads higher than 6 %.

(a normal reading is 5 %)

IF THE ALARM IS VALID, THEN:

3. IF PERSONNEL ARE IN ACCESS, ACTIVATE THE EVACUATE ALARM

4. If the Central Detector is in the Collision Hall,

NOTIFY THE MCR OF THE CDF INERTING ALARM CONDITION.

5. TAKE PRECAUTIONARY SHUTDOWN ACTIONS

(a) Have the Gas Tech stop Argon / Ethane flow to CTC, and CDT.

(b) Shutdown the high voltage to VTX, CTC, and CDT using ACNET.

(c) Send a crew member to shutdown low voltage to the CTC / VTX
at rack **RR27C**, 1st floor counting room.

Crew member should open clear plexiglass covers and set all
switches into the DOWN position.

(d) Send a crew member to shutdown the SVX

at rack **RR12H**, 1st floor counting room.

Crew member should hit all 4 SVX Crash Buttons

labelled East and West "Power Shutoff" and "Cooling Shutoff".

6. NOTIFY PERSONNEL ON THE CDF NOTIFICATION CALL LIST.

7. CONFIRM SHUTDOWNS & FORMULATE ACTION PLAN.

Call inerting experts & inform CDF Operations Manager before acting.

Notify SVX, VTX, CTC, and CDT personnel of shutdown actions taken.

IF THE ALARM IS FALSE, THEN:

8. An alarm is false if no sensor reads above 6% when checked at Rack RRG04.
RESET ALARM, RESUME NORMAL OPERATION.
Inform the CDF Operations Manager.

3.0 Checklist

No "Procedure Execution Form" is required for this safety procedure. Instead the CDF Alarm Coordinator should record the steps taken in the CDF SOD logbook in the CDF Control Room.

4.0 Deviations from the Procedure

None are allowed.

5.0 Required Training and Authorized Training Personnel.

There is no prerequisite training for this procedure.

Authorized training personnel are listed below:

Don Mizicko, ID# 704

John Pawlak, ID# 9381

Both are qualified by experience in the design / implementation of the CDF Gas Alarm systems.

6.0 Training Materials.

No written materials exist.

A lecture must be given by one of the authorized training personnel.

This lecture must include a tour with stops and instruction at:

1. CDF Control Room display for inerting alarms
2. Relay Rack #1 in the Cryogenic control area, with a discussion of the specific sensors which can trip.
3. Inerting monitor jug and sample draw pump in the Gas Rack area
4. Gas Rack area, Relay Rack RRG04, oxygen monitor readout.
5. Discussion of rules regarding oxygen monitor repairs, see page 4 of this procedure.

7.0 List of Trained People for this procedure.

The list of trained people for this procedure should exist in written form in the CDF Department copy of this procedure.

The list may eventually reside in a Lab-wide database as well.

8.0 References and Supporting Documentation.

CDF Gas Safety Systems: CTC/CDT Nitrogen Inerting System
by R. Kadel (1/11/87), revised by J. Pawlak (4/2/92), copy attached.