Collider Detector at Fermilab (CDF)

Section III – Chapter 1

Revision 3
September 26, 2014

Revision History

Author(s)	Description of Change	Revision No. & Date
Angela Aparicio	Revision of the SAD after detector dismantling	Revision 3 September 26, 2014
Keith Schuh	Revision of SAD for Run II	January 25, 2001
John Elias?	Revision of SAD	June 1, 1995

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III - 1 CDF Detector

III - 1.1 CDF Detector Location on Fermi National Accelerator (Fermilab) Site

The Collider Detector at Fermilab building is located at the B0 straight section of the Tevatron Collider Ring, along D Road, across from the Industrial Center Building.

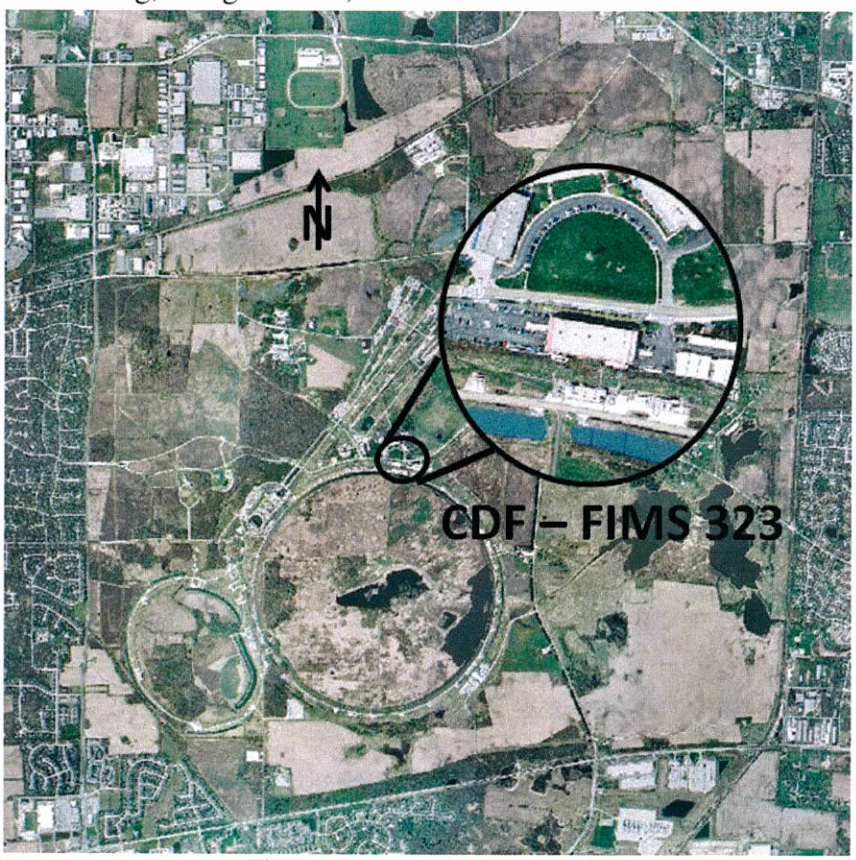

Figure 1: Aerial view of CDF site.

Figure 2: CDF (orange) and Illinois Accelerator Research Center (IARC) Office, Technical & Education (OTE) buildings.

III - 1.2 Inventory of Hazards

The following table lists the identified hazards found in the CDF site. All hazards with an * have been discussed in Chapters 1-10 of the Fermilab Safety Assessment Document (SAD) and are covered no further in this section.

Radiation Lasers Radioactive sources Residual activation*	**Kinetic Energy** Power tools* Pumps and motors*
Toxic Materials Beryllium Lead	**Potential Energy** Crane operations*
Flammable & Combustible Materials Cables* Flammable gas systems	**Magnetic Fields** Superconducting solenoid
Electrical Energy High voltage*	**Gaseous Hazards** Confined spaces* Cryogenic systems Flammable gas systems Oxygen deficiency hazard Halon fire suppression system
Thermal Energy None	**Access / Egress** None

III - 1.3 Introduction

This Section III, Chapter 1 of the Fermi National Accelerator Laboratory (Fermilab) Safety Assessment Document covers the CDF site.

III - 1.3.1 Historical Background

CDF first detected antiproton/proton collisions in 1985, and continued taking data until the end of the Tevatron Collider physics run in September 2011. A large number of important physics results have been obtained with these data, including the discovery of the Top quark.

Beginning in 2012, the Illinois Accelerator Research Center (IARC) began construction of the Office, Technical & Education (OTE) building on the West side of the CDF Assembly Building. The addition is now complete and attached to the CDF building. In the future, the CDF Assembly Building will be renamed the Heavy Assembly Building (HAB). The scope of this chapter is limited to the CDF experiment and facility and does not include the OTE. The safety

assessment of IARC program activities will be addressed in a separate SAD chapter as they evolve.

III - 1.3.2 Description of the CDF Facility

Since the cessation of Tevatron operations, many components of the former CDF Detector experimental apparatus have been removed from the CDF building for purposes of reuse, recycling and waste disposal. The CDF building contains the Collision Hall, where what remains of the detector is located, the Assembly Hall Pit, a high-bay area, and former office space. The Assembly building is equipped with a 50-ton crane.

There is one elevator and one stairway connecting all levels of the building, located in the middle of the building. A second stairway leads from the first floor to the Assembly Hall pit. The below-ground portions of the two stairways serve as tornado shelters for personnel in the CDF building, adjacent office trailers and IARC OTE building. A third stairway at the East end of the building also connects the three floor levels but does not descend to the pit.

The Collision Hall, where the CDF detector resides, is connected to the Assembly Hall pit in three different locations: A "controlled access" door at the mouth of a labyrinth, a 50-ton concrete "door" used for "supervised access" and a 1200-ton shield door. An isolation wall separates the Collision Hall from the Tevatron tunnel at both ends of the Collision Hall.

III - 1.3.3 Operating Modes

As stated above the CDF detector is no longer in operation, due to the retirement of the Tevatron. The remaining portion of the partially-dismantled detector has been placed back in the CDF collision hall. The present utilization of the building is discussed in the next section.

III - 1.3.4 Changes to the CDF Facility and Detector

The counting rooms, office areas and meeting rooms on the second and third floors have been cleared out for future IARC program activities. Some of the equipment from the trigger and control areas of the second floor counting room were placed in storage, to be used in a future display.

The cable-carrier bridge was removed to increase crane coverage of the deep pit.

The Time of Flight scintillators were removed from inside the solenoid and have been saved. The electromagnetic sections of the plug calorimeters were removed. The plugs were remounted on the central detector.

The outer muon systems were dismantled. The barrel muon (BMU) chambers were removed from the collision hall. The half-torroid units were cut apart by ironworkers into constituent blocks. The blocks have been transferred to the railhead and are saved for future use as shielding. The 100-ton ceiling steel has been removed. All electronics and cables have been removed. Scintillators and phototubes have been removed and saved for reuse. The central muon extension (CMX) arches were dismantled and chambers removed from the lower section. Columns on the lower section were cut down; the columns and counterweight were taken to the railhead to be scrapped.

Inside the collision hall the shielding around the low-beta quadrupole magnets was removed. All abandoned cables have been removed. Electrical equipment for the 400 Hertz power was scrapped. Any items removed that were found with residual radioactivity have been moved to storage at the Railhead, in accordance with the usual procedures.

The central detector was returned to the collision hall, and the assembly building is undergoing renovations to support IARC program activities.

III - 1.4 Safety Assessment

This section identifies the hazards of the CDF Detector and discusses how the hazards are managed. These hazards include lasers, sealed radioactive sources, magnetic fields, toxic materials, and gaseous hazards, such as cryogenics and oxygen deficiency hazards.

III - 1.4.1 Radiological Hazards

III - 1.4.1.1 Lasers

Class 3B lasers were used during CDF Run II to provide light sources for detector calibration. All lasers have been removed from the building and returned to the collaborators who provided them for the CDF experiment.

III - 1.4.1.2 Radioactive Sources

The 97 Cesium-137 sources mounted in the arches and endwall calorimeter remain in place on the detector. The central muon system still contains 153 Iron-55 sources shielded by lead, and the sources are inaccessible without the proper tools. These sources present a potential for low radiation exposures to the worker if handled improperly. All sources will remain on the detector until the detector is fully dismantled. The sources will continue to be managed per the

radioactive source controls in the Fermilab Radiological Control Manual (FRCM) Chapter 4: *Radioactive Materials*, and will remain on the Laboratory's inventory of radioactive sources.

III - 1.4.2 Static Magnetic Fields

Static magnetic fields can produce a variety of health symptoms, including nausea and vertigo. During operations, the central detector contained a 1.5 Tesla superconducting solenoid. The solenoid has been disconnected and removed, thereby eliminating the static magnetic field hazard.

III - 1.4.3 Toxic Materials

III - 1.4.3.1 Beryllium

Beryllium is a toxic metal that can cause health issues if its particulates are inhaled, ingested or through skin contact. The CDF beam pipe contained approximately 453 grams of beryllium. The beam pipe was removed from the detector and has been returned to the Accelerator Division and placed in storage.

III - 1.4.3.2 Lead

The passive material in all the CDF calorimeters is lead. Lead is a toxic metal that can cause health issues if particulates are inhaled or ingested. The lead remains in the finished modules of the shower counters and is not handled or touched. When the remaining detector is decommissioned, all lead safety practices will be followed, per Fermilab Environment, Safety and Health Manual (FESHM) Chapter: *Special Toxic Hazards – Lead-Containing Materials*. Only workers trained in Lead Handler or Lead Worker training will handle lead components.

III - 1.4.4 Gaseous Materials

III - 1.4.4.1 Flammable Gas

All flammable gas lines have been purged and connections have been isolated. The gas shed behind the assembly building was removed.

III - 1.4.4.2 Cryogenic Liquids

All cryogenic lines have been purged and connections have been isolated. All cryogenic storage tanks have been removed.

III - 1.4.4.3 Oxygen Deficiency Hazard

All gases that created the ODH are no longer in use and the equipment has been removed.

III - 1.4.4.4 Halon Fire Suppression System

The Halon in the collision hall remains but the firing pins have been removed. The Halon systems in the counting rooms were removed and the Halon returned to the Fermilab Refrigerant Manager, per the requirements of the FESHM Chapter: *Refrigeration Management*.

III - 1.5 Credited Controls

III - 1.5.1 Passive Controls

CDF does not require passive controls due to the non-operational status of the detector.

III - 1.5.2 Active Controls

CDF does not require active controls due to the non-operational status of the detector.

III - 1.5.3 Administrative Controls

Administrative procedures and programs that were in place (e.g. CDF Supervised Access training) are no longer necessary at the CDF site as the experiment is no longer in operation and no beam is being delivered.

III - 1.5.4 Conclusion Concerning Credited Controls

There are no credited controls at CDF.

III - 1.6 Decommissioning

The CDF Assembly Building has been incorporated into the new IARC OTE building. The remaining components of the CDF Detector will remain secured in the collision hall until final disposition. Final decommissioning of the CDF Experiment will follow the requirements of FESHM Chapter: *Facility Decontamination and Decommissioning*. The PPD ES&H Manual 014 - *ES&H Review of Expired Experiment Decommissioning and Dismantlement* is available to help identify and mitigate ES&H hazards during decommissioning.

III - 1.7 Summary & Conclusion

The hazards specific to operations and decommissioning of the CDF detector have been identified and assessed in this chapter of the Fermilab Safety Assessment. All designs, controls, and procedures to mitigate CDF-specific hazards are identified and described. The CDF Experiment is subject to the global and more generic safety requirements, controls and procedures outlined in Section 1 of the Fermilab Safety Assessment Document.

Within the specific and generic considerations of this assessment, the CDF Experiment can be decommissioned with a level of safety that will protect people and property and is equal to or exceeding that currently prescribed by Department of Energy orders and Fermilab regulations as put forth in the FESHM and the FRCM.

III - 1.8 Glossary, Acronyms

BMU	Barrel Muon Chambers
CDF	Collider Detector at Fermilab
CMX	Central Muon Extension
ES&H	Environment, Safety and Health
Fermilab	Fermi National Accelerator Laboratory
FESHM	Fermilab Environment, Safety, and Health Manual
FRCM	Fermilab Radiological Control Manual
IARC	Illinois Accelerator Research Center
ODH	Oxygen Deficiency Hazard
OTE	Office, Technical and Education
PPD	Particle Physics Division
SAD	Safety Assessment Document

III - 1.9 References

1. 2001 CDF Run II Safety Assessment Document – The current link is: https://esh-docdb.fnal.gov:440/cgi-bin/RetrieveFile?docid=936
2. Fermilab Environment, Safety and Health Manual (FESHM) - The current link is: http://esh.fnal.gov/xms/ESHQ-Manuals/FESHM
3. Fermilab Radiological Control Manual (FRCM) – The current link is: http://esh.fnal.gov/xms/ESHQ-Manuals/FRCM