

BASELINE
FIRE PROTECTION FACILITY ASSESSMENT

FOR

BUILDING 9116

AT

Y-12 PLANT, OAK RIDGE, TENNESSEE

**[PREPARED AS A MODEL ASSESSMENT
FOR A NEW FACILITY]**

MARCH, 1993

REV. 4

PREPARED FOR
DEPARTMENT OF ENERGY

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1.0 INTRODUCTION

1.1 Purpose and Approach

This assessment is intended to evaluate the fire hazards, life safety and fire protection features inherent in Building 9116.

The assessment approach included a review of the fire protection records and drawings of Building 9116, several field walkdowns of the building, identification of known fire hazards and previous deficiencies, and a field review of the life safety and fire protection features of the building.

1.2 Facility, Use, Function, and Occupancy

Building 9116 is a two story office building that is occupied by approximately 70 personnel. The building is used as offices for the Health, Safety, Environmental, and Accountability Division. There is no central data processing center, and no rooms with a large number of personnel or valuable equipment.

This building is classified as a New Business occupancy per the Life Safety Code, and classified as a B-2 Business occupancy per the UBC.

1.3 General and Site Fire Protection

The fire protection for the Y-12 Plant, which is pertinent to Building 9116, consists of a site wide fire alarm system, a fire service main and water supply, and a plant fire department. All are adequate for this building. Refer to Reference (a) for further details on plant fire protection features.

2.0 CONSTRUCTION

2.1 Description of Facility

Building 9116 is a two story steel frame and brick veneer building constructed to codes and standards in effect in 1990. Due to the slope of the plant site, the first floor is at grade level on the south side of the building, while the second floor is located at grade on the north side. The bottom level of the building is constructed with poured concrete walls with a brick exterior veneer. The first level floor assembly consists of concrete on fluted steel pans and bar joist on load bearing walls for support. With a suspended ceiling in place, this assembly conforms to UL Design G201 and provides a one hour fire rating. The second floor does not have interior

concrete walls, but has gypsum board and metal studs walls. The brick veneer is attached directly to the exterior walls. The roof assembly does not incorporate steel bar joists for support. The roof is a flat built up membrane over a fluted steel deck supported by the main building beams. The roof construction is a FM Approved Class I assembly. Interior partitions are gypsum board and metal studs. The corridor walls around the mechanical (HVAC) room and electrical closets are slab to slab. Other corridor walls extend only to the suspended ceiling. The occupied areas have a suspended acoustical tile ceiling. The type of construction is considered to be Type II (000) as specified by NFPA 220 or Type II-N per the Uniform Building Code (UBC). The approximate gross area per floor is 6,525 square feet. Floor plans are provided in Appendix A.

2.2 Fire Boundaries

This building is basically one fire area based upon the DOE definition of Fire Area, which states that the area must be bounded by construction having a minimum fire resistance rating of 2 hours with openings properly protected. However, the first and second floors are separated by a floor/ceiling assembly having a 1 hour fire resistance rating (UL G201) for conformance to the Uniform Building Code. The main stairway is isolated by one hour fire rated gypsum board barriers and self closing Class B, 1-1/2 hour rated fire door assemblies. A small lobby area has been constructed from the stairway door on the first floor to the exterior door of the building. Fire doors, rated for 45 minutes for the Class C openings, have magnetic holders, operated by smoke detectors. These detectors are installed in the corridor to isolate the exit enclosure from the interior corridor. The mechanical (HVAC) room is isolated by one hour fire rated gypsum board construction. The electrical equipment room and the janitor's closet on each floor are isolated by one hour fire rated gypsum board construction. Penetrations through the fire rated barriers in these rooms are adequately sealed. Corridor walls in the office areas extend only to the non-rated suspended ceiling, which is noncombustible construction. Fire rated corridors are not required in the building per NFPA 101, since the business occupancy is under common management. The office doors are wood without closers. The fire separations in this building provide an adequate level of protection for the fire hazards present, and provide an adequate level of life safety for the building occupants. The fire separation meets NFPA-101, Uniform Building Code, and DOE criteria.

3.0 LIFE SAFETY

3.1 Means of Egress

Building 9116 is served by two exits on each level. The stairway from the second floor discharges to the first floor corridor, however, rated fire doors for Class C openings (3/4 hour fire

rating) have been installed to separate the exit from the first floor, forming a protected means of egress. The doors are held open by magnetic holders that are automatically released by smoke detectors on each side of the doors. When closed, the doors form a protected means of egress from the stairway enclosure to the double doors on the south side of the building.

Two exits are provided for each floor of the building. The exits are located in different parts of the building and arranged so as to be reached by different paths of travel in different directions. Total travel distance to an exit is estimated to be 100 feet or less. The exit capacity significantly exceeds the occupant load of 65 persons per floor calculated according to Section 26-1.71 of NFPA 101-88. Therefore the exit capacity is acceptable. The remote exits are separated by a straight line distance of 58 feet. The overall building diagonal is 116 feet. The exit remoteness is therefore acceptable for a non-sprinkler protected building. The means of egress for this building comply with NFPA 101, meet the exit requirements in the UBC, and are adequate for the protection of the building occupants.

3.2 Emergency Lighting and Exit Signs

Battery pack emergency lighting units are used for the illumination of the primary exit paths. Dual head units are located in the corridors, as well as in the enclosed stairway. Illuminated exit signs are installed above the exit doors and in the exit corridors. The exit signs are well placed and properly mark the direction of exit travel. The provisions for emergency lighting and the location of the exit signs are considered acceptable for this building, except for the deficiency noted in Section 7.4.E of this assessment.

4.0 FIRE HAZARDS

4.1 Identification of Significant Fire Hazards

There are no significant fire hazards in this facility.

The potential fire hazards and fire loading in the complex are those of a typical office occupancy. Office furniture, personal computers, bookcases, technical publications, and metal file cabinets are found in most rooms. A break room with small appliances, such as toaster ovens, is located on each floor of the building. The doors to the break rooms are usually kept open. Electrical switchgear and breaker panels are located in separate rooms on each floor. No unusual concentrations of combustibles were observed. All electrical conduits are metal.

4.2 Runoff/Containment of Fluids.

In the event of a major fire, runoff from fire fighting operations would likely drain out of the building and towards the south, due to the existing slope at this location. A system of storm drains is installed at the plant site. The runoff would enter the storm drain system. No

additional measures are necessary as there is no contamination or hazardous materials in this building.

5.0 FIRE PROTECTION

5.1 Water Supply and Distribution System

Local eight inch diameter mains in the section of the plant, where Building 9116 is located, are supplied by two 16 inch diameter lines and two ten inch lines, which are supplied by multiple feeds from the plant fire main. The main feeds connect to an eight inch diameter loop south of the building. Three hydrants serve the area. Hydrants 310 and 311 are on the eight inch line in front of the building along First Street. Hydrant 214 is on the eight inch line on the east side of the building. Isolation valves are provided, and adequately spaced on the fire fighting water distribution system.

5.2 Fire Suppression

Building 9116 is not provided with automatic sprinklers. NFPA 101 criteria do not specify sprinkler protection for a building of this floor area, number of stories and occupancy type. DOE criteria at the time construction was started did not require automatic sprinklers in buildings with an MPFL of less than 1 million dollars. The 1991 Factory Mutual Survey and Report of the Y-12 Plant stated that the addition of automatic sprinkler protection of the building was "not considered economically feasible".

No standpipe systems are installed in this building. Interior fire attack will be done using fire department equipment. Access to the interior of the building is adequate for the fire department to reach all areas with a standard 200 foot pre-connected line.

Multipurpose dry chemical fire extinguishers, having 10A-60BC ratings are installed throughout the corridor areas of Building 9116. Travel distance and extinguisher capacities are within the criteria specified in NFPA 10 for a Business occupancy.

5.3 Protective Signaling System

Building 9116 is connected to the plant-wide Gamewell fire alarm system. Any manual pull station or smoke detector activation will automatically be transmitted to the Y-12 Plant Fire Department. Standard operating procedure is for the fire department to respond to the master box, then determine the fire location from the target annunciator located next to the master box.

The local alarm control panel and manual pull stations are connected to Master Box #313, located on First Street southwest of the Building. The local control panel is located in the building by the

first floor entrance on the south side of the building. This panel is a Gamewell Zans 400 model with six zones. Each manual pull station is wired as a separate zone, and so is the duct smoke detector. The alarm system includes two manual pull stations on each floor by the exits, three smoke detectors located in the first floor lobby area, one smoke detector at the top of the stair, and duct smoke detectors for the HVAC system.

5.4 Adequacy of Protection

Building 9116 is a typical low rise office building. There are very limited fire hazards, and the building structure is non-combustible. An adequate number of remotely located exits are provided for the occupants. The plant fire department has ready access to the building, and the water supply at that location is excellent. An automatic sprinkler system is not considered necessary for these reasons.

NFPA 101 does not specify an alarm system for a Business occupancy of this number of stories and floor area. The installation of the fire alarm system in this building exceeds both NFPA and DOE criteria. The detection and alarm system sends a signal to the fire station and to the Plant Shift Superintendent's control center, but does not initiate automatic local alarms or automatic announcements. All personnel alerting signals are announced over the plant PA system from the Plant Shift Superintendent's control center. This includes all site emergencies such as severe weather, weather, radiation incidents, fires, etc. The PA system is installed in each building, as well as in the yard areas, and is routinely tested. Although the PA system is not a UL listed fire alarm audible indicating system, it is tested and used daily. This is considered to provide an acceptable level of reliability as compared to UL listed appliances that are only periodically tested. This system has a UPS secondary power supply with diesel driven generator back-up. The PA system has been evaluated by Factory Mutual at the plant and found to be acceptable to FM.

One deficiency was identified during the assessment of the fire detection and suppression systems. The local fire alarm control panel located by the first floor lobby is not marked to indicate what areas are protected by each zone of the system. The control panel should be properly labeled to indicate the detection zones in the building (Recommendation 11.2).

With the correction of this deficiency, the fire protection equipment in Building 9116 is considered acceptable for the safety of the employees and government owned equipment.

5.5 Fire Department/Fire Brigade Response

5.5.1 Pre-fire Plans

Pre-fire plans have not been prepared for this small office building. Due to the uncomplicated

nature of the building, and lack of hazardous materials, contamination, and fire department connections for installed systems, no pre-plans are considered necessary.

5.5.2 Apparatus Access to Facility

Based upon a review of the Y-12 Fire Department response records over the last 12 months, the response time for the Y-12 Fire Department to Building 9116 is less than 2 minutes from receipt of the alarm or call. The distance from the fire station to the complex is approximately 1/4 mile.

5.6 Facility Fire Training

There is no fire brigade for this building.

Employee training in fire protection consists of portable fire extinguisher training, hazard recognition, and fire alarm reporting.

6.0 FACILITY EQUIPMENT AND PROGRAM PRESERVATION

6.1 Protection of Essential Safety Class Systems

No essential class safety systems are contained in this building.

6.2 Critical and Vital Programs

6.2.1 Identification of Vital Programs Impacted

Building 9116 contains no programs vital to the DOE mission.

6.2.2 Identification and Protection of Critical Process Equipment.

No critical process equipment is located in this building.

6.2.3 Identification and Protection of High Dollar Value Equipment

The only equipment in this building with a high dollar value is the secured computer network which is routed throughout the corridors of the building. An exact value on this equipment is not available, but it is estimated by the authors to be less than \$100,000. No fire protection features

are provided to protect this equipment from fire damage. In a credible fire situation, this equipment is expected to suffer heat and smoke damage.

6.3 Facility Damage Potential

6.3.1 Maximum Credible Fire Loss (MCFL)

The FHA predicts the MCFL for this building to be \$900,000 or less. This is based upon the Y-12 Plant Finance Department's replacement value for the building of \$560,000. The contents are estimated at \$280,000 for the office equipment and furnishings. Clean up costs associated with an office building fire, less the salvage value, in a non-radiological area having no hazardous chemicals is estimated at \$60,000. The downtime for the facility and potential loss of proprietary computer equipment and records located in the building are judged to be the largest loss. Because this building is not sprinkler protected, a fire could spread to the corridor and cause fire and smoke damage to most offices, with structural damage to the building.

6.3.2 Maximum Possible Fire Loss (MPFL)

The FHA considers the MPFL for this building to be the same as the MCFL, as there is no installed fire extinguishing system.

These estimates have been reviewed against the current occupancy and condition of the building. The estimated values are considered to remain valid.

6.4 Security Coordination

There are no impediments created by the security system that would prevent timely evacuation of Building 9116.

The fire department responds to fire emergencies from a station located inside the protected area of the plant. Standard operating procedures are in place to assure that the emergency response through security gates is not delayed exiting the protected area. The security provisions for this building would have no adverse impact on fire fighting operations.

7.0 PROGRAM DOCUMENTATION

7.1 Currency and Completeness of FHA

The Fire Hazards Analysis for this building is dated March 1993. The FHA is complete and accurately represents the hazards present in this building. The FHA concludes that Building 9116 has no major fire protection deficiencies, and no additional fire safety features are

recommended. The FHA is acceptable in its present form.

7.2 Previous Facility Appraisal Reports

A Facility Appraisal Report was performed for Building 9116 in January 1992 by the plant Fire Protection Engineering group. The contents of the report covered the fire hazards, potential risks, life safety, and fire protection features of the facility.

7.3 Review of Temporary Protection and Interim Compensatory Measures

No interim compensatory measures are in place or necessary for this building.

7.4 Status of Findings From Previous Assessments

There are currently seven findings on record for this building. These findings are from previous building assessments and are maintained on the ESAMS Tracking System. The previous findings and their current status are listed below:

A. Finding #101-291 - The first floor exit sign by the west exit has an incorrect directional arrow. The sign should be replaced with an exit sign showing the path to the west exit door.

This finding is closed. A proper directional arrow has been provided.

B. Finding #2-4 - An unnecessary smoke detector is installed in the second floor corridor near the stairway door.

The smoke detector is still present. It is provided to activate the first floor magnetic door closers for the exit passageway. This detector should remain in place and the finding should be deleted.

C. Finding #2-5 - The fire alarm sign on the north wall of the second floor south corridor should be on the south wall above the manual pull station.

This finding is closed. The sign has been relocated.

D. Finding #80-81 - Fire door S106 has a faulty latch mechanism.

This finding is closed. The fire door latch has been adjusted and functions as intended.

E. Finding #101-423, 276, and 465 - A quantitative study of emergency lighting coverage has not been conducted to verify minimum illumination levels.

This finding remains open.

F. Finding #101-20 - The first floor lobby doors are smoke check type doors provided with integral closing mechanisms. The doors do not close simultaneously. Replace the closers with detector operated magnetic hold back devices.

This finding is closed. The doors are operated by magnetic hold back devices released by the smoke detection system.

G. Finding #101-288 - The exit sign by the west door on the first floor is not illuminated.

This finding is closed. The exit sign has been repaired.

7.5 Evaluation of Administrative Controls

Building fire inspections are performed by the Y-12 Fire Department on a monthly schedule per department procedures. Hot work in the building is controlled by the plant's welding and burning procedures. In the event of outage of the fire alarm system and detection system in the building, the plant's compensatory procedure is implemented. Quantities of flammable and combustible liquids introduced into the building are also controlled by plant level procedures. The administrative controls are considered adequate for this office building.

There was one deficiency identified in this area, The exit corridors in the building are obstructed by boxes of copier paper, recycling bins, and wooden boxes. In some areas, the exit access was measured at 39 inches. All of these items should be permanently removed from the exit corridors, as they pose a risk to the occupants attempting to leave the building in an emergency, and add to the combustible loading in the area. (Recommendation 11.1)

7.6 Documentation of Exemptions and Equivalencies

There are no exemptions or equivalencies on record for this building.

8.0 OPERATIONS AND MAINTENANCE

8.1 Review and Evaluation of Procedures for Inspection, Maintenance, and Testing

Inspections and tests of the office building fire protection features are performed by the fire department personnel on a scheduled basis. Functional tests are conducted on the smoke detectors, manual pull stations, and Master Box #313. Hydrant flow tests are performed annually. Tests results are analyzed using hydraulic gradients to assess water main degradation,

and results are compared to previous flow test data. Some records and results of the tests were checked and found to be adequate.

Building 9116 has adequate testing and maintenance provisions to ensure that the building is fire safe for the occupants. Provisions for inspection, testing, and maintenance of fire protection equipment in Building 9116 are acceptable.

8.2 Review and Evaluation of Corrective Actions and Work Order Priority

Life safety and fire protection deficiencies are given top priority for corrective action at the Y-12 Plant. Corrective actions are performed in a timely manner for life safety related findings.

8.3 Fire Protection Engineering Staffing

One fire protection engineer from the plant's Fire Protection Engineering group provides engineering services to Building 9116 and the adjacent facilities in this plant area.

8.4 Facility Management Support of Fire Protection Program

The facility management responsible for Building 9116 has supported the fire protection program by correcting identified deficiencies within the building.

9.0 SUMMARY OF IDENTIFIED DEFICIENCIES

9.1 Deficiencies Related to DOE Orders

No deficiencies were identified in regard to DOE Orders.

9.2 Deficiencies Related to NFPA Standards

1) The exit corridors in this building are obstructed by boxes of copier paper, recycling bins, and wooden mail boxes. In some areas, the exit access was measured at under 39 inches. NFPA 101-91, Section 31-1.2.1 (Recommendation 11.1)

2) The local fire alarm control panel in the lobby area near the south exit lacks identification of the detection zones in the building. NFPA 72, Section 2-4.6 (Recommendation 11.2)

9.3 Deficiencies Related to Other Codes

No deficiencies related to UBC or other codes were identified.

9.4 Other Deviations From Good Practice

No deviations from good practice were identified.

10.0 CONCLUSIONS

Building 9116 is a Business occupancy building with very limited fire hazards and very limited dollar loss potential. The existing level of protection is considered adequate, except for the previous identified deficiencies.

11.0 RECOMMENDATIONS

11.1 Remove all combustible materials and obstructions from the exit access corridors (Section 7.5).

11.2 Identify the building fire alarm zones on the local control panel (Section 5.4).

12.0 REFERENCES

- (a) "Site-Wide Fire Protection Features", Y-12 Plant, Y/XP-198, dated February 10, 1992
- (b) Fire Hazards Analysis for Building 9116, dated March 1993

APPENDIX A
BUILDING 9116 FLOOR PLANS AND SITE PLAN

APPENDIX B

QUALIFICATIONS OF AUTHORS

Randall Eberly: B.S. degree in Fire Protection Engineering from the University of Maryland; Registered Professional Fire Protection Engineer; 21 years experience in fire protection engineering as a private consultant and as an employee of the Nuclear Regulatory Commission, U.S. Coast Guard, Tenera, and Events Analysis.

Robert O'Laughlin: B.S. degree in Fire Protection Engineering from the University of Maryland; Registered Professional Fire Protection Engineer; Certified Safety Professional; 32 years experience in fire protection engineering as a private expert and as an employee of Professional Loss Control, Union Carbide, and the Tennessee Valley Authority.

ANNEX # 1

Date: June 1995

A re-assessment of building 9116 was conducted by Randall Eberly and Robert O'Laughlin in June 1995. The construction, occupancy, and use of the building have not changed. No conditions were identified that vary from the Baseline Assessment conducted in 1993. Deficiencies identified in the Baseline Assessment have not been corrected. No new findings were identified.