Fire Modeling for St. Lucie Nuclear Plant Unit 1, Cable Spreading Room
Office of Nuclear Reactor Regulation
Division of Systems Safety and Analysis
Plant Systems Branch
Fire Protection Engineering and Special Projects Section
Docket No. 50-335

Scope and Objectives

Fire modeling of the St. Lucie Nuclear Plant (SLNP) Unit 1, cable spreading room (CSR) has been performed to predict the potentially hazardous conditions (increased temperature) that could exist during a postulated fire and to assess the associated potential damage to the CSR in accordance with the guidelines provided in National Fire Protection Association, NFPA 805, Appendix C, 2001 Edition. The multi-zone fire model CFAST (Consolidated Model of Fire Growth and Smoke Transport) was used to determine the room conditions for the different fire scenarios.

Assumptions and Limitations

The results of this analysis are predicated on the assumption that the ignition occurs. The ignition sources are representative of the potential hazards in a combined CSR and switchgear room. [Note: the ignition frequency of fires resulting from an ignition source is accounted for in the significance determination process (SDP) (NRC Inspection Manual, 2001), Ignition Frequency (IF) term]. Further, it is assumed that the fire occurs in the CSR and will burn without intervention from the plant fire brigade. Due to significant design deficiencies, no credit is given to the Halon 1301 fire suppression system installed in the CSR (see Fire Protection Functional Inspection (FPFI) Report, 1998 for details). In the absence of technical information to the contrary, conservative worst case assumptions are made regarding the fuel loading, fire heat release rates (HRRs), and fire growth and spread in CSR. This will result in a conservative, yet realistic analysis.

Ignition Sources Fire Characterization

It is not a sound safety engineering practice to rely on controlling the fire hazards solely by attempting to control or limit potential ignition sources. The ignition sources that may cause the most damaging fires could also be the result of multiple failure modes. Thus, ignition sources are identified to demonstrate their existence and to provide a basis from which to assume ignition of fuel sources. This issue was discussed in May 29, 1980, Federal Register notice for the Proposed New Rule of 10 CFR 50.48 Appendix R:

> *"The guidelines in both the BTP 9.5-1 and Appendix A to BTP 9.5.1 were developed to provide a fire protection program that has two basic objectives:*
>
> *1. to identify and distinguish between those consequences of fire that are acceptable and those consequences that are not.*
>
> *2. to provide necessary means to minimize all consequences of fire and to prevent unacceptable consequences from occurring.*
>
> *With respect to the first objective, the phenomenon of fire is believed to be sufficiently well understood to permit evaluation of existing and potential fire hazards and probable extent of damage should a fire occur. Such evaluations are useful in assessing the possible*

consequences of fire in a given area. However, the phenomenon of fire is so unpredictable in occurrence and development that measures to prevent unacceptable consequences may not be omitted on the basis of low probability of occurrence. The minimum fire protection requirements for nuclear power plants must be established not only to identify fire hazards but also to protect against unacceptable consequences of fire".

This is particularly true, in any location where electrical energy is distributed and used. Electrical components and connections are potential fire ignition sources.

The NFPA Industrial Fire Hazard Handbook 3rd Edition states (Whittington, 1990): "In recent years, particularly on high-fault capacity, low-voltage 208Y/120-volt systems, there have been numerous reported cases of arcing fault burnouts in which severe damage to, or complete destruction of, electrical equipment has been caused by the energy released in the arc. Typically, the arcing fault becomes established between a phase and ground, or between phases and ground. The fault arc releases enormous amounts of energy based on the amperes squared multiplied by time (I^2t), with heat so intense that it vaporizes copper or aluminum conductors and destroys the surrounding steel enclosures (melting point temperature of copper and aluminum is 1084 °C (1983 °F) and 660 °C (1220 °F) respectively). Any combustibles stored in the immediate vicinity of the equipment would also be ignited".

The NFPA Fire Protection Handbook, 18th Edition, Table 3-1E provides an overview of 1989 through 1993 structural fires due to electrical distribution equipment reported to U.S. fire departments that were coded as caused by electrical failures (Caloggero, 1997). This statistic shows that 40,350 structural fires were reported to the various fire departments due to electrical distribution equipment involved in ignition (see Table 1).

Table 1 Structure Fire Due to Electrical Failure
(Annual Average of 1989 Through 1993 Fires Reported to the U.S. Fire Departments)

Electrical Distribution Equipment Involved in Ignition	Average Number of Fires per Year
Fixed wiring	15,850
Transformer	790
Meter or meter box	740
Overcurrent protection device (e.g., fuse, circuit breaker)	2,880
Switch, receptacle, or outlet	4,420
Lighting fixture, lamp holder, ballast, or sign	5,130
Cord or plug	7,040
Lamp or light bulb	720
Unclassified type	1,210
Unknown type	1,570

Further, preliminary, yet unreleased NRC research derived from actual reactor operating experience assessment suggests that the HRR currently assumed in fire risk models has been significantly under estimated up to a possible factor of 1000 for high voltage arc faults.

Therefore, potential sources of ignition which cannot be ruled out are electrical equipment and components. The fire hazard arises from the electrical discharge from equipment/component/cable followed by ignition of surrounding combustibles, namely cable jackets and insulation in this analysis. For the fire scenarios developed in this fire modeling the source of ignition will be assumed to be an electrical failure.

Fire Scenario Development

The primary combustibles of concern in the CSR are the in-situ electrical cables. A potential cable tray fire will pose a significant hazard to the CSR. The worst case scenario is dominated by the cable trays that are closest to ignition sources. Ignition sources in the CSR including, but not limited to, the pressurizer heater transformers, power programmer cabinets, numerous 480V load centers, DC distribution panels, and reactor trip switchgear. Another credible fire scenario is possible from self-initiated cable fire. A credible fire propagation pathway exists in the power programmer cabinets, 480 reactor auxiliary common motor control center (MCC) 1AB, vital AC Static Uninterruptible Power Supply (SUPS), and DC bus 1AB-1. For this analysis the failure of 480 reactor auxiliary common MCC 1AB, vital AC SUPS, and DC bus 1AB-1 are considered as examples of credible potential ignition sources. These ignition sources are chosen because all of these are open from top and are 2 ft to 3 ft below the cable trays (Note: this was apparent from viewing the video-SLNP Unit 1 Cable Spreading Room Fire Protection and Prevention Features with Halon 1301 System). Other ignition sources such as a power cable failure in a tray, or other failures of electrical origin (distribution panel, circuit boards, electrical wiring, internal cable fault, electrical circuit fault in switchgear cabinets, etc.) will provide similar results. The electrical failure is used in this analysis to ignite the in-situ combustibles (cables) and its probability of failure (cause ignition) factored into the fire frequency and fire severity factors in the SDP. Outside ignition sources such as hot work or transient sources are possible, but beyond the scope of this analysis. In this analysis failure of 480 reactor auxiliary common MCC 1AB, vital AC SUPS, and DC bus 1AB-1 causes preheating of cables leading to cable failure, thus initiation of a secondary fire in the cable trays.

Three different fire scenarios were considered in the analysis. They are: (1) a cable tray fire with mechanical ventilation on (supply and exhaust), (2) a cable tray fire with exhaust fan on only, and (3) a cable tray fire with mechanical ventilation off.

Heat Release Rate Estimate

The essential component of the fire modeling is the determination of the HRR characteristics of the critical fuel. As previously stated the critical fuel of concern in the CSR is the electrical cables. For this type of analyses, a broad approximation of burning rates is acceptable. For instance, post flashover structure analyses are often based on the fire duration or fire severity associated with an aggregate fuel loading (combustible load per unit floor area). However, if it is essential to estimate specific fire effects within an enclosure, a more accurate determination of burning rate characteristics (i.e., HRR) is necessary. For this analysis, the HRR for cable tray fires will be approximated as "slow" fire growth rate.

The HRR is not a fundamental property of a fuel and, therefore, cannot be calculated from the basic material properties alone. Estimates of fire source intensities (HRR) can be based either on direct burning rate measurements of similar large fuel configurations or the extrapolation of small-scale test data obtained under simulated thermal conditions. Representative unit HRR values for a number of fuels present in the nuclear power plant (NPP), e.g., cables, electrical cabinets, flammable/combustible liquids, and transient combustibles have been measured and reported in various reports (Lee, 1981, Lee, 1985, Hill, 1982, Nowlen, 1986, Nowlen, 1987, Chavez, 1987, Braun et al., 1989, and Babrauskas et al., 1991). Typically, flammable/combustible liquid spill fires and trash fires are the most commonly postulated transient fuel exposure fires in NPPs. Typically, cable and electrical cabinet fires constitute the most commonly postulated fixed fuel fires.

Fire Growth Rate

Testing has shown that the overall HRR during the fire growth phase of many fires can often be characterized by the simple time dependent polynomial or exponential function (Heskestad and Delichatsios 1978). The total heat release of fuel packages can be reasonably approximated by the power law fire growth model for both a single item burning and for multiple items involved in a fire. The proposed model of the environment generated by fire in an enclosure is dependent on the assumption that the fire grows according to:

$$\dot{Q} = \alpha t^2 \qquad (1)$$

where,

$\dot{Q}$ = the rate of heat release of fire (kW),
t = the time (sec), and
α = a constant governing the speed of fire growth (kW/sec^2)

The growth rate approximately follows a relationship proportional to time squared for flaming and radially spreading fires and is referred to as t-squared (t^2) fires. The t^2 fires are classed by speed of growth, labeled as ultra-fast, fast, medium, or slow. Where these classes are used, they are defined on the basis of the time required for the fire to grow to a rate of heat release of 1000 kW (1 MW). The intensity α, and growth time t, related to each of these classes is shown in Table 2.

Table 2 Summary of t^2 Fire Parameter

Type of Fire Growth	Intensity Constant α (kW/sec^2)	Growth Time t (sec)
Slow	0.00293	600
Medium	0.01172	300
Fast	0.0469	150
Ultra-fast	0.1876	75

The t^2 relationship has proved useful and has been adopted into the National Fire Protection Association NFPA 72 to categorize fires for detector spacing requirements and NFPA 92B for design of smoke control systems.

The modeled fire can be represented as one where the HRR per unit area is constant over the entire ignited surface and the flame is spreading with a steadily increasing area. In such cases, the burning area increases as the square of the steadily increasing fire radius. Fires that do not have a regular fuel array and consistent burning rate might or might not actually produce a t^2 curve; however, the t^2 approximation appears to be reasonable for use in this case to produce a realistic approximation of the expected fire growth.

Test data on a large number of cable tray configurations and cable types demonstrated that the peak heat release rate per unit area and the horizontal and vertical flame propagation rate vary considerably (Lee, 1985, Nowlen, 1987, and Braun, *et al.,* 1989). For the purpose of this analysis a t^2 slow growth rate for the cable fires was assumed and is appropriate for this type of fuel based on the experiments conducted by Lee, 1981. Additionally, as a worst case scenario, the cable trays are assumed to ignite at the bottom of the lowest tray. This means that the entire cable tray will become readily involved, producing a larger peak HRR.

Since the primary combustibles in the CSR are the electrical cables jacket insulation made of PE/PVC, a HRR of 589 kW/m^2 (~ 600 kW/m^2)is selected for this analysis based on the bench-scale test data (Babrauskas, 1995). This type of cable jacket insulation is common in NPPs of SLNP, Unit 1 vintage.

CFAST - Consolidated Model of Fire Growth and Smoke Transport

The multi-zone computer fire model CFAST was used to calculate the temperature in the CSR [Peacock *et al.,* 1997; Peacock *et al.,* 1993]. CFAST was developed by the Building and Fire Research Laboratory (BFRL) at the National Institute of Standards and Technology (NIST) for fire modeling steady and unsteady state burning rates in multiple compartment configurations (multiple room capability, up to 15 rooms can be modeled). The initiating fire is user specified, but adjusted by CFAST based on the available supply of oxygen. CFAST allows fires to be constrained or unconstrained. A fire specified as unconstrained in CFAST will not be limited by the availability of oxygen. When a constrained fire is specified, the chemically required oxygen is calculated and the available oxygen and unburned gases are tracked. A mass balance calculation of individual species is performed for each zone to track the available oxygen and unburned gases. Multiple compartments and vents can be modeled as well as the mechanical ventilation. Mechanical ventilation is addressed by CFAST in terms of fan/ductwork that includes consideration of fan pressure/flow characteristic curves and duct friction losses. The model divides each compartment into two zones, an upper zone containing the hot gases produced by the fire and a lower zone containing all space beneath the upper zone. The lower zone is a source of air for combustion and usually the location of the fire source, the upper zone can expand to occupy virtually all of the space in the compartment. The upper zone is considered a control volume that receives both mass and energy for the fire and loses energy to the surfaces in contact with the upper zone by conduction and radiation, by radiation to the floor, and by convection or mass movement of gases through openings. The two layer zone approach used by the CFAST has evolved from observations of such layering in full-scale fire experiments (Jones *et al.,* 2000). While these experiments show some variation in conditions within the layers, they are small compared to the differences in conditions between the layers themselves. Thus, the zone model can produce a fairly realistic simulation of the fire environment within a compartment under most conditions. CFAST has the capability to calculate the upper and lower layer temperature, the smoke density, the vent flow rate, the gas concentrations, and compartment boundary temperatures, the heat flux from the smoke layer to objects, the internal compartment pressure, and the interface elevation, all as a function of time.

A number of efforts of CFAST model comparison, verification and validation have been undertaken. Many of these efforts involved comparisons between measured and calculated parameters, primarily temperatures, mass flow rates and smoke layer interface positions. Duong, 1990, Peacock, et al., 1988, Mowrer and Gautier, 1997, Nelson and Deal, 1991, and EPRI, 1998, compared CFAST model predictions with experimental data.

Limitations and Uncertainties Associated with Fire Modeling

Fire models permit development of a better understanding of the dynamics of building fires and can aid in the fire safety decision-making process. There are certain limitations and uncertainties associated with the current fire modeling predictions. Extreme care must be exercised in the interpretation of the fire modeling results. For scenarios where the level of predicted hazard is well below the damage threshold, the results can be used with high level of confidence provided there is a high level of confidence that all risk-significant scenarios have been considered. For scenarios where the level of predicted hazard is near the damage threshold, the results should be used with caution in view of the uncertainties that exist.

A primary method of handling modeling uncertainties is the use of engineering judgment. Among other things, this judgment is reflected in the selection of appropriate fire scenario, hazard criteria, and fire modeling techniques. A slightly more formal application of engineering judgment is the use of safety factors. The safety factors can be applied in the form of fire size, increased or decreased fire growth rate, or conservative hazard criteria (Custer and Meacham, 1997). Experimental data obtained from fire test, statistical data, from actual fire experience, and other expert judgment can be used improve the judgment and potentially decrease the level of uncertainty.

CFAST Modeling of CSR Conditions

Fire modeling of the SLNP, Unit 1, CSR conditions using CFAST was performed. A list of necessary inputs for CFAST is provided in Table 3. With the parameters chosen, CFAST provided information on the temperature in the room, the smoke interface height, and species concentration. In order to gain insights into the different possible fire scenarios, three types of ventilation configurations were considered in the fire dynamics modeling.

CFAST input data includes the physical dimensions of the compartment, the compartment construction materials, the opening dimensions and elevations, the fire HRR, and the position of the fire in the specified room, gas species production rate, the mechanical ventilation parameters, and exterior wind conditions. All CFAST input files used in this analysis are contained in Appendix A.

HRR curves were developed for the PE/PVC with a t^2 slow fire growth rate. Table 4 provides the peak HRR for the CFAST fire model based on the assumed surface burning area of the cable tray. The input HRR assumes complete combustion and an ample supply of oxygen.

Table 3 Description of the CFAST Input Data File

1	Compartment geometry: Width x Depth x Height = 20.72 m x 14.94 m x 5.48m
2	Natural ventilation - Vent connection (horizontal and vertical flow connections between compartment in the structure including doors between compartment or window in the compartment between compartment or to the outside: Opening Width = 1 m, Height = 0.15 m (0.15 m^2)
3	Mechanical Ventilation: Supply Air = 24800 cfm, Exhaust Air = 24800 cfm

4	Compartment construction and thermal properties of the enclosing surfaces, i.e., ceiling, wall, and floor - Concrete
5	Fire specification: information on the source of fire location, area of source fire, chemical properties of the fuel, heat of combustion of the fuel, species yields, fuel mass loss rate, and heat release of the fire as a function of time.

The fire environment created in the CSR involving PE/PVC cable jacket insulation was determined using the data provided in Tables 4. HRR curves in Table 4 were developed for input into CFAST, which will reduce this nominal HRR based on the availability of oxygen. All fires were run in the room with the door closed (the CSR door is expected to be closed is the normal plant configuration). A small vent was assumed near the floor in the CSR to prevent an excessive pressure buildup and possible numerical instability in the model. This small vent assumption is a summation of small leakage paths such as door gaps.

This condition allows for sufficient oxygen in the lower layer for combustion but limits the quantity of smoke and hot gases that are lost through the openings. Due to the large volume of the space, it is reasonable to assume that there is sufficient oxygen in the lower layer for combustion (i.e. fuel limited fire). It is also reasonable to assume that the intensity of the fire is not reduced due to oxygen limitations. The walls, floor, and ceiling of CSR were assumed to be thermally thick concrete.

Table 4 Heat Release Rate Results for PE/PVC t^2 Slow Fire Growth Rate

PVC Cable Tray Surface Burning Area (m^2)	Heat Release Rate of PVC Cable Jacket Insulation (kW)	Time to Peak Heat Release (sec)
1	600	453
2	1200	640
3	1800	784
4	2400	906
5	3000	1012
10	6000	1431

Although the fire heat release is not changed in the modeling, three ventilation scenarios were modeled to represent possible configuration when a fire occurs in the CSR.

1. Door closed, mechanical ventilation on (supply and exhaust), with leakage.
2. Door closed, exhaust fan on only, with leakage.
3. Door closed, mechanical ventilation off with leakage.

In all above ventilation scenarios, the doors leading from the CSR to adjacent areas are assumed to be closed during the fire simulation. However, if the door is not initially open during a fire (e.g., upon receipt of a fire alarm in the main control room (MCR), an operator will likely open the door to investigate fire existence in the CSR. If the facility's fire brigade needs to open the door for manual fire-fighting, this door is expected to be open throughout the fire-fighting efforts. This door opening allows additionally air into the CSR and results in a more intense fire than when door is closed. This could significantly change the impact of the fire on the CSR. The "open door fire scenario" could yield a larger fire due to this increased ventilation. Opening a door could also delay the ventilation limited conditions allowing this fire to burn somewhat longer. Thus, upper layer temperatures in the CSR would be expected to increase until such time that the fire brigade has an effect on the fire.

CFAST Fire Modeling Results

Results from the CFAST simulation of the three ventilation scenarios in the CSR are summarized in Table 5.

Table 5 Summary of Fire Modeling Results for Cable Fires in CSR

PE/PVC Cable Tray Surface Burning Area (m^2)	Heat Release Rate of PE/PVC Cable Jacket Insulation (kW)	Upper Gas Layer Temperature °C (°F)		
		Mechanical Ventilation On (supply and exhaust)	Exhaust Fan On Only	Mechanical Ventilation Off
1	600	68 (155) steady state in 23 minutes	68 (155) steady state in 23 minutes	146 (295) at 60 minutes
2	1200	119 (246) steady state in 54 minutes	119 (246) steady state in 52 minutes	232 (450) at 60 minutes
3	1800	175 (347) steady state in 56 minutes	175 (347) steady state in 58 minutes	304 (579) at 60 minutes
4	2400	191 (376) at 16 minutes	233 (452) steady state in 58 minutes	364 (687) at 60 minutes
5	3000	209 (408) 15 minutes	292 (558) at 60 minutes	415 (779) at 60 minutes
10	6000	484 (903) at 60 minutes	500 (932) at 29 minutes	484 (903) at 60 minutes

Effects of Fires on CSR

Results from the CFAST simulation of the three ventilation scenarios in the CSR have been summarized in Table 5. The results show that there is sufficient oxygen available in the CSR, even without mechanical ventilation and the door closed, such that a significant fire can be sustained for some period of time. The upper gas layer temperature with mechanical ventilation on (supply and exhaust) and with exhaust fan on only, can lead to a flashover, an unacceptable condition. Flashover is a phenomenon, which defines the point in a compartment fire where all combustibles in the compartment are involved and flames appears to fill the entire volume. During a fire, the exhaust fan will remove smoke from the hot gas layer and raise the elevation of the layer interface.

This exhaust will allow the fire to burn at a higher intensity since more fresh air will be entrained into the fire from the lower layer. Due to the high temperatures of the upper gas layer, it is also possible that the exhaust fan could fail during the fire. Note that spread of fire through the exhaust duct is beyond the scope of this analysis and is not evaluated.

The predicted peak temperature in the CSR with mechanical ventilation off indicates that the flashover condition was not achieved in the CSR due to ventilation limitations. The predicted peak temperature in the space was below the temperature associated with the flashover [500 to 600 °C (932 to 1112 °F) (Walton and Thomas, 1995)]. During normal operations, the doors from CSR to other areas are closed. As such, there are no large openings available (according to the licensee) to allow air into the CSR to feed the fire. This will result in the fire becoming ventilation limited and thus it will burn at a lower intensity. The peak HRR is ultimately determined by the amount of fresh air available to the fire. However, the CSR is not perfectly sealed, and gaps around the door and small cracks around the CSR will allow the passage of air from the outside. Improper ventilation of the CSR by the fire brigade during suppression activities could potentially lead to flashover/backdraft conditions.

Conclusion from Fire Hazard Modeling

An analysis was performed to determine whether cable trays exposed to an ignition source would produce a significantly hazardous condition in the CSR. CFAST modeling has been used to determine the CSR conditions with different ventilation configurations and different size fires as previously cited.

The effects of CSR fire have been modeled using the HRR from the PE/PVC cable jacket insulation with various cable tray exposed surface areas. Temperatures and products of combustion in the CSR could result in damage to the entire CSR and all in-situ combustibles. Without prompt automatic/manual fire suppression, hazardous conditions are expected to occur in a relatively short period of time in the CSR. Note that no specific information is available regarding the amount of cables in the trays, cable composition, i.e., polymers used for insulation jackets, and dimensions of cable trays.

Based on the results of the fire modeling and its conservative assumptions, it can be concluded that a fire in the CSR could have a significant impact on the CSR. Depending on the ventilation condition and exposed surface area involved, it is possible for the room to flashover. This could result in failure of the CSR area structure and potentially allow the fire to spread throughout the plant in the absence of an adequate fire suppression system. This is significant considering the close proximity of the post-fire alternative safe shutdown panels. Thus this fire model supports the significance determination process (SDP) analysis.

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APPENDIX - A

Computational Fire Modeling CFAST Input Data
Cable Spreading Room
St. Lucie Nuclear Plant, Unit 1

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VERSN  3   St. Lucie Unit 1 CSR, Mechanical Ventilation Off
TIMES 3600  60  60  60   0
TAMB  298. 101300. 0.0
EAMB  298. 101300. 0.0
HI/F   0.0
WIDTH  20.72
DEPTH  14.94
HEIGH  5.48
HVENT  1  2  1  1.5  1.5   0.0
CEILI  CONCRETE
WALLS  CONCRETE
FLOOR  CONCRETE
CHEMI 16. 10. 2.  24000000.  298.  388. 0.0
LFBO  1
LFBT  2
FPOS  -1.0  -1.0  0.0
FTIME 10.0   1012.0
FHIGH 3.0 3.0
FAREA 1.0 1.0
FQDOT 0.0  1.172E3  3000E3
CJET OFF
CO    0.14  0.14
OD    0.05  0.05
HCR   0.30 0.30
STPMAX  1.00
DUMPR CSR.Hi
DEVICE 1
WINDOW   0  0. -100. 1280. 1024. 1100.
GRAPH 1  170.  300.   0. 625.   820.  10.  5  TIME CELSIUS
GRAPH 2  765.  300.   0. 1220.  820.  10.  5  TIME FIRE_SIZE (kW)
LABEL 1  970.  960.   0. 1231.  1005. 10.  15 00:00:00    0.   0.
LABEL 2  690.  960.   0. 987.   1005. 10.  13 TIME_ [SEC] 0.   0.
TEMPERA  0  0  0  0  1   1 U
HEAT     0  0  0  0  2   1 U
```

```
VERSN  3   St. Lucie Unit 1 CSR, Mechanical Ventilation On
TIMES 3600  60  60  60   0
TAMB  298. 101300. 0.0
EAMB  298. 101300. 0.0
HI/F   0.0
WIDTH  20.72
DEPTH  14.94
HEIGH  5.48
HVENT  1  2  1  1.5  1.5   0.0
MVOPN  1  3  H  2.8  0.16
MVOPN  2  1  H  2.8  0.16
MVOPN  1  4  H  5.0  0.16
MVOPN  2  6  H  5.0  0.16
MVDCT  1  2  0.5  0.2  0.002  0.0  1.0  0.0  1.0
MVDCT  5  6  0.5  0.2  0.002  0.0  1.0  0.0  1.0
MVFAN  2  3  0.0  500.0  11.70
MVFAN  4  5  0.0  500.0  11.70
INELV  1  2.8  2  2.8  3  2.8  4  5.0  5  5.0  6  5.0
CEILI  CONCRETE
WALLS  CONCRETE
FLOOR  CONCRETE
CHEMI 16. 10. 2.  24000000.  298.  388. 0.0
LFBO  1
LFBT  2
FPOS  -1.0  -1.0  0.0
FTIME 10.0   1012.0
FHIGH 3.0 3.0
FAREA 1.0 1.0
FQDOT 0.0  1.172E3  3000E3
CJET OFF
CO    0.14  0.14
OD    0.05  0.05
HCR   0.30 0.30
STPMAX  1.00
DUMPR CSRM.Hi
DEVICE 1
WINDOW   0  0. -100. 1280. 1024. 1100.
GRAPH 1  170.  300.   0. 625.   820.  10.  5  TIME CELSIUS
GRAPH 2  765.  300.   0. 1220.  820.  10.  5  TIME FIRE_SIZE (kW)
LABEL 1  970.  960.   0. 1231.  1005. 10.  15 00:00:00    0.   0.
LABEL 2  690.  960.   0. 987.   1005. 10.  13 TIME_ [SEC] 0.   0.
TEMPERA  0  0  0  0  1   1 U
HEAT     0  0  0  0  2   1 U
```

```
VERSN  3   St. Lucie Unit 1 CSR, Exhaust Fan On Only
TIMES 3600  60  60  60   0
TAMB  298. 101300. 0.0
EAMB  298. 101300. 0.0
HI/F   0.0
WIDTH  20.72
DEPTH  14.94
HEIGH  5.48
HVENT  1  2  1  1.5  1.5   0.0
MVOPN  1  1  H  5.0  0.16
MVOPN  2  3  H  5.0  0.16
MVDCT  2  3  0.5  0.2  0.002  0.0  1.0  0.0  1.0
MVFAN  1  2  0.0  500.0  11.70
INELV  1  5.0  2  5.0  3  5.0
CEILI  CONCRETE
WALLS  CONCRETE
FLOOR  CONCRETE
CHEMI 16. 10. 2.  24000000.  298.  388. 0.0
LFBO  1
LFBT  2
FPOS  -1.0  -1.0  0.0
FTIME 10.0   453.0
FHIGH 3.0 3.0
FAREA 1.0 1.0
FQDOT 0.0  1.172E3  600E3
CJET OFF
CO    0.14  0.14
OD    0.05  0.05
HCR   0.30 0.30
STPMAX  1.00
DUMPR CSRE.Hi
DEVICE 1
WINDOW   0  0. -100. 1280. 1024. 1100.
GRAPH 1  170.  300.   0. 625.   820.  10.  5  TIME CELSIUS
GRAPH 2  765.  300.   0. 1220.  820.  10.  5  TIME FIRE_SIZE (kW)
LABEL 1  970.  960.   0. 1231.  1005. 10.  15 00:00:00    0.    0.
LABEL 2  690.  960.   0. 987.   1005. 10.  13 TIME_ [SEC] 0.    0.
TEMPERA  0  0  0  0  1   1 U
HEAT     0  0  0  0  2   1 U
```