McGuire Nuclear Station
Cask Drop Analysis

In order to allow an alternative to the use of the Duke Power Company NFS-4 cask for the shipment of spent fuel from Oconee Nuclear Station to McGuire Nuclear Station, we submit the following information concerning the use of an NLI-1/2 cask. This analysis evaluates the consequences of dropping or tipping, or a combination of both, of the NLI-1/2 cask in the McGuire spent fuel handling building.

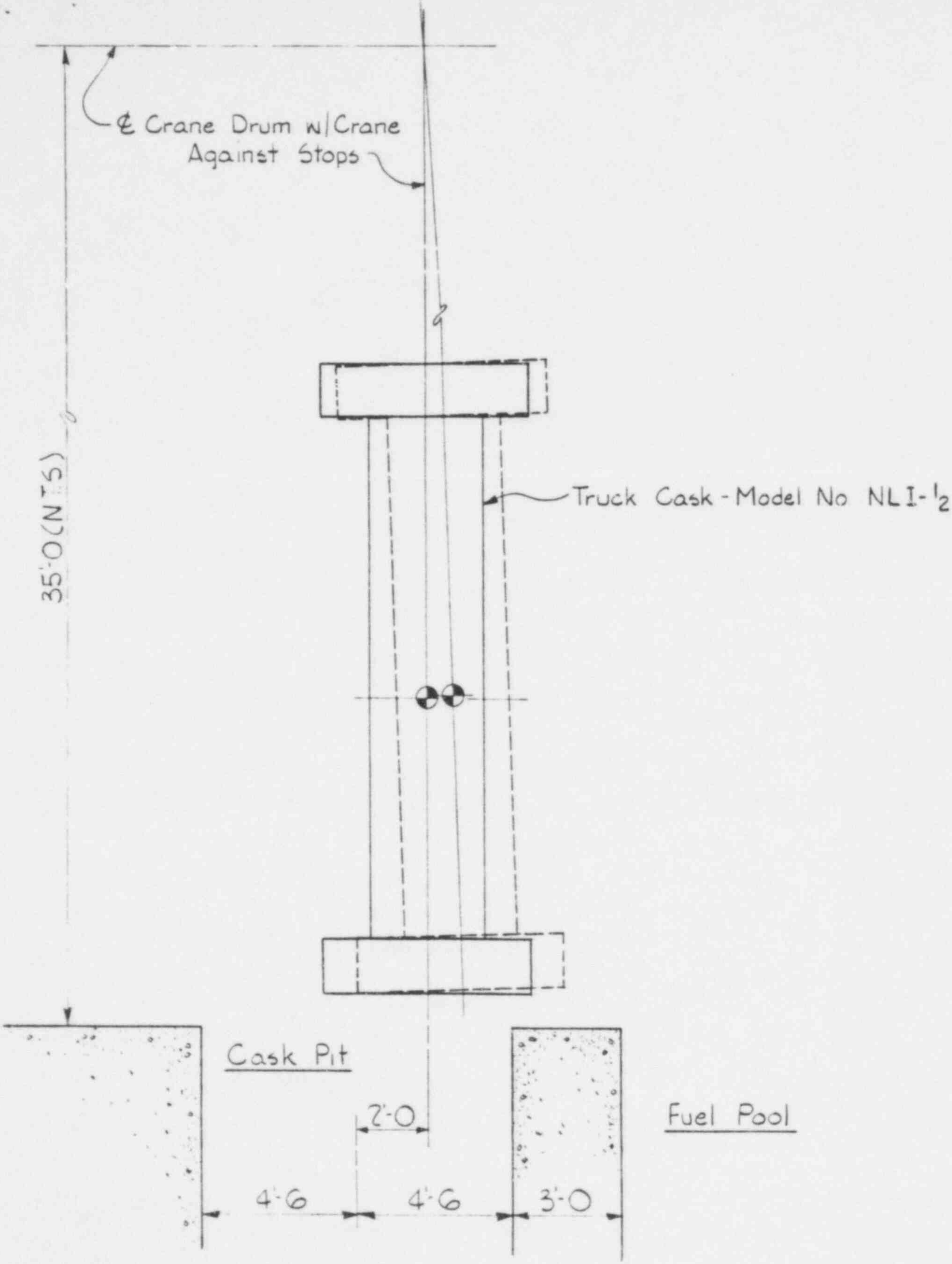
The NLI-1/2 cask is a truck cask licensed by National Lead Company and is Model No. NLI-1/2. The cask weighs approximately 25 tons and is 200 inches long including top and bottom energy absorbers. The area in which the cask is handled is designed for a 30 foot drop of a proposed 100 ton rail cask and the structure is reinforced concrete with a rock foundation. Local damage to the concrete will be negligible and no safety related equipment is located in the cask travel path. The following circumstances of dropping the cask were considered to be most critical and the assumptions and conclusions are presented:

Case #1 - The cask handling crane is assumed to be traveling at its maximum speed of 50 fpm and hits the crane stops nearest the spent fuel pool. The crane stops, and the cask is assumed to continue traveling toward the spent fuel pool rotating about a line through the centerline of the crane drum. The cask continues to swing until the kinetic energy is completely converted to potential energy (i.e. the cask raises up as it rotates about the crane drum). At the instant the cask swings as close to the spent fuel pool as possible, the cable breaks and the cask falls. The conclusion is that the cask falls on the edge of the spent fuel pool wall and falls away from the spent fuel pool due to its center of gravity being behind the wall. See Sketch #1 for an illustration of this case.

Case #2 - The cask handling crane is assumed to be traveling at its maximum speed of 50 fpm and hits the crane stops nearest the spent fuel pool. The crane stops and the cable breaks at the same instant, therefore the cask does not swing but is moving at 50 fpm. The cask is assumed to be at its highest position, which is approximately 4 feet off the floor. The distance the cask travels at 50 fpm in the time it takes for the cask to fall 4 feet is determined. The cask will hit the spent fuel pool wall and tend to rotate about its edge on the wall. It is determined that the amount of kinetic energy is not sufficient to cause the cask to fall into the spent fuel pool. See Sketch #2 for an illustration of this case.

Case #3 - The cask is assumed to be over the edge of the cask pit wall and the cable breaks. The cask either drops on the edge of the wall or the cask is lowered on to the edge of the wall. Either case gives the same initial conditions because in the event of a drop the kinetic energy is assumed to be absorbed by the cask's bottom energy absorber. Therefore, the cask's potential energy will cause the cask to tip toward the spent fuel pool wall. Energy losses at impact with the spent fuel pool wall are conservatively considered and the results of the analysis show that the remaining energy is not sufficient to cause the cask to fall into the spent fuel pool. See Sketch #3 for an illustration of this case.

In order to provide additional assurance that the cask will not fall into the spent fuel pool, the path of the cask will be controlled by application of administrative control as shown on Sketch #4. By requiring the cask to follow this path, the circumstances of Case #3 cannot occur and any potential for the cask falling into the spent fuel pool is negated.



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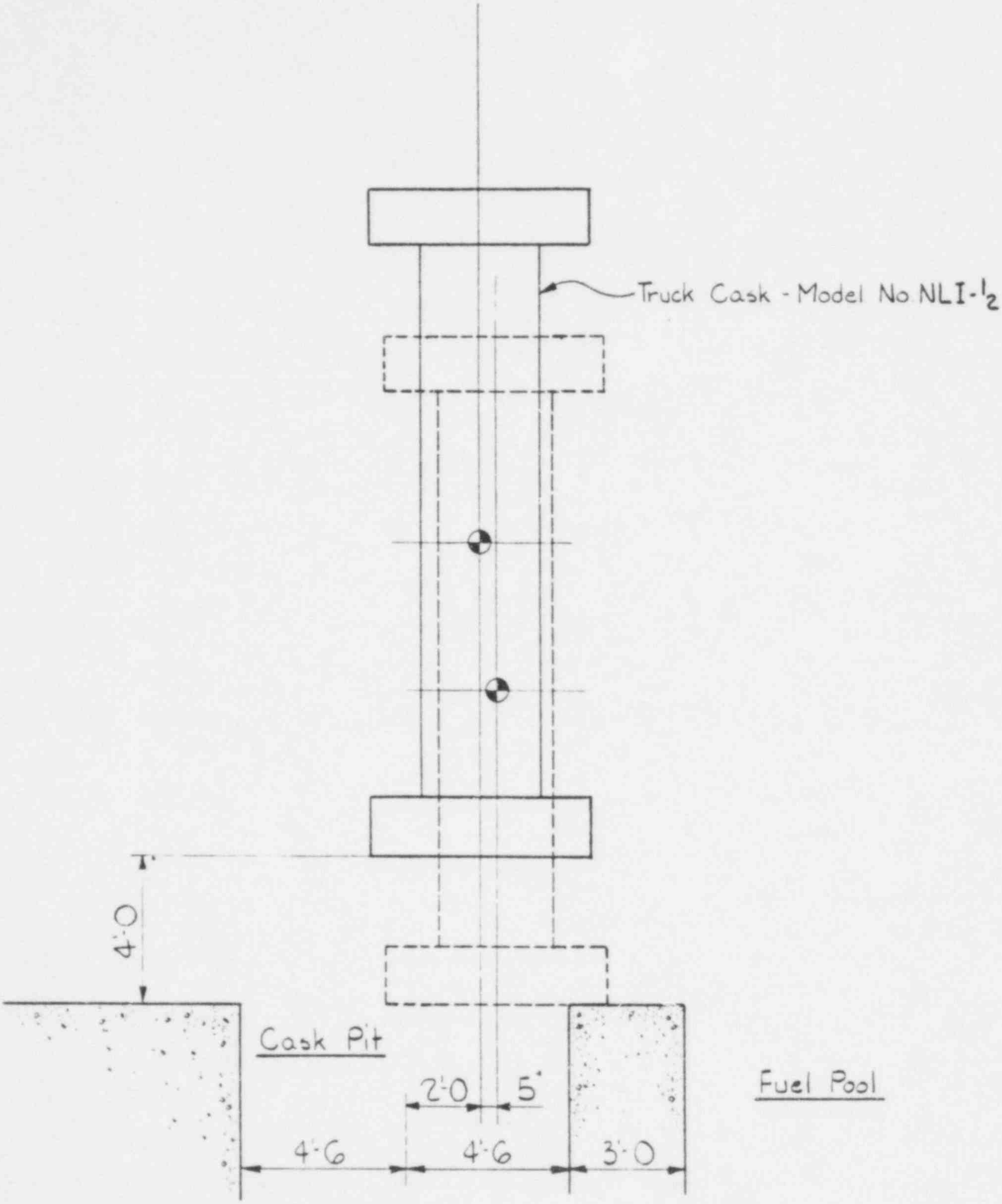
Sketch # 1



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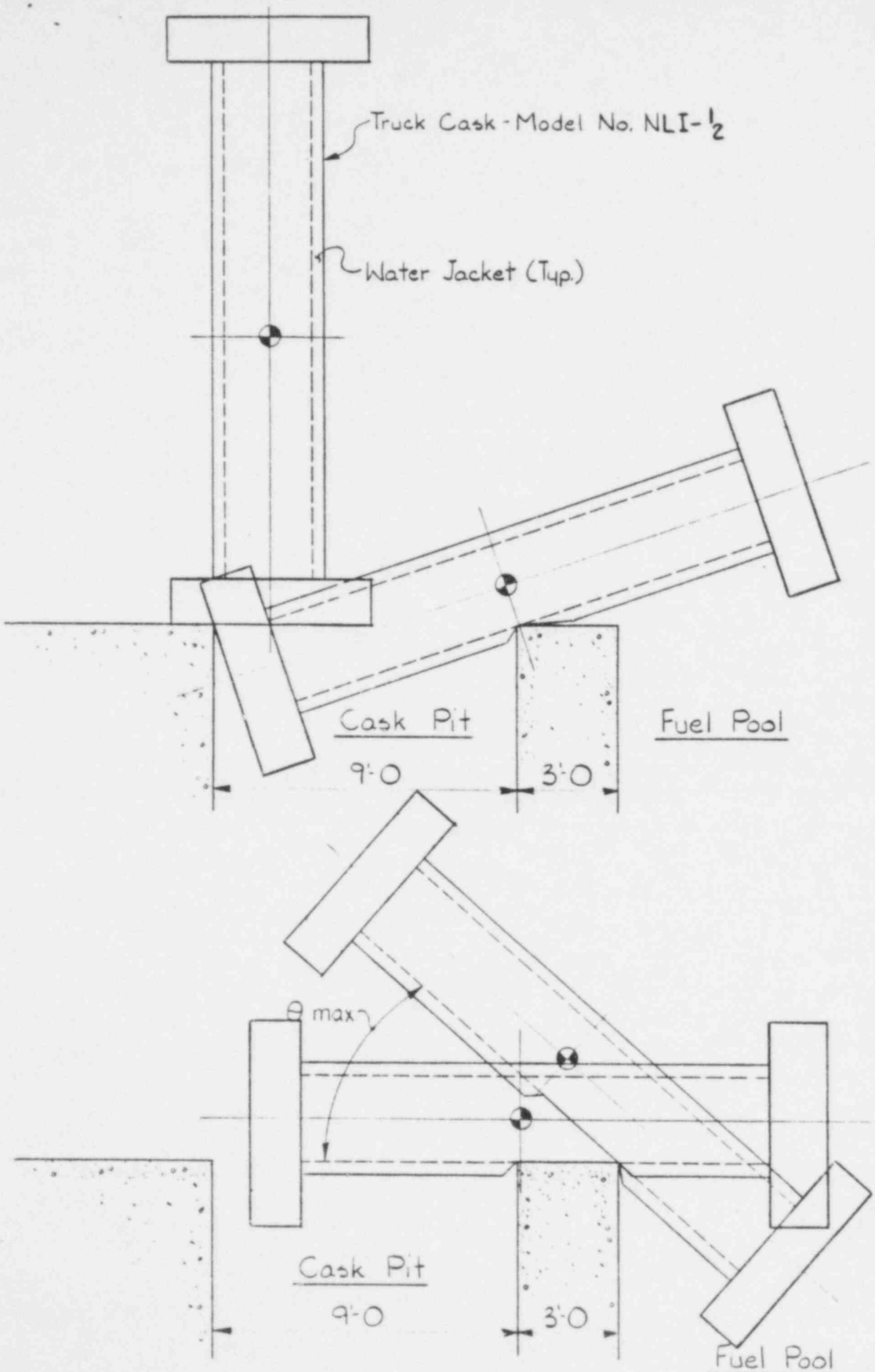
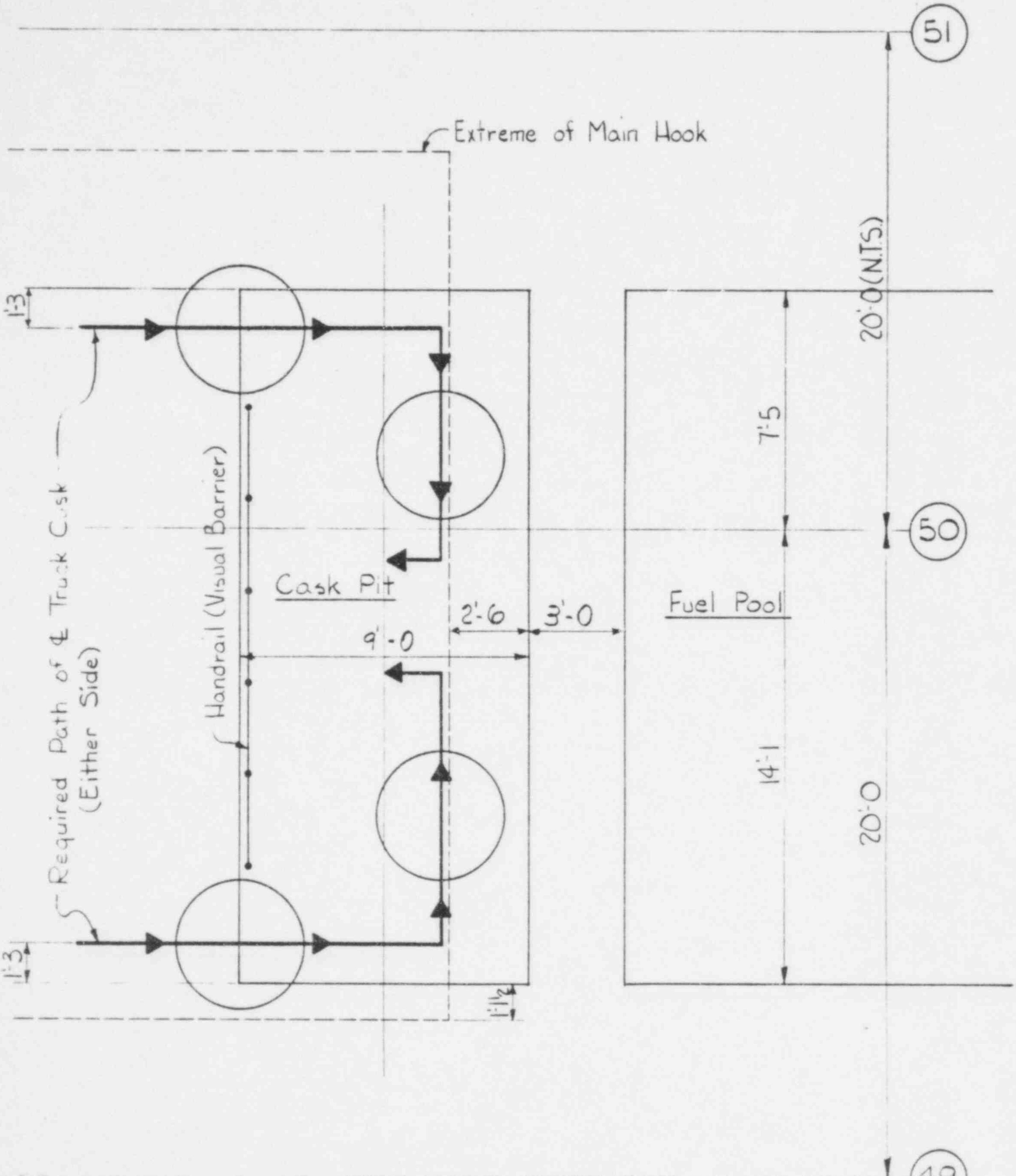
SKETCH #2


Truck Cask - Model No. NLI-1/2
Water Jacket (Typ.)
Cask Pit
Fuel Pool
9'-0
3'-0
θ max
Cask Pit
9'-0
3'-0
Fuel Pool

SKETCH #3



599076 Sketch #4