

SEP 13 1977

DOCKET NO. 50-346

APPLICANT: TOLEDO EDISON COMPANY

FACILITY: DAVIS-BESSE, UNIT 1

SUBJECT: BACKGROUND AND SUMMARY OF MEETING HELD ON AUGUST 25, 1977 WITH THE TOLEDO EDISON COMPANY REGARDING THE INSTRUMENT-STATION GROUND GRID SYSTEM FOR THE DAVIS-BESSE, UNIT 1

A meeting was held on August 25, 1977 with the Toledo Edison Company and the NRC staff regarding the presently installed instrument to station ground gridsystem at Davis-Besse, Unit 1. An attendance list is provided in Enclosure 1.

Background

On August 17, 1977 the Toledo Edison Company at a meeting with the NRC staff reviewed the design criteria for the Davis-Besse, Unit 1 instrument to station ground grid system. As a result of station testing it had been determined that there may be inadvertent ties between the instrument and station ground at other than the commonly designed tie point. The systems that may have the station ground and instrument ground connected included the Reactor Protection System-Nuclear Instrumentation, Non-Nuclear Instrumentation, Station Computer, Integrated Control System, and the non-essential Miscellaneous Electric Control System.

Summary

The Toledo Edison Company presented their analysis of the potential effect of these possible inadvertent ties on the safety instrumentation systems for a postulated worst possible electrical fault that would introduce ground currents into the station electrical ground gridsystem. A summary of their analysis presented at the meeting is provided in Enclosure 2.

Based on the analysis for worst case faulted conditions, the Toledo Edison Company stated that safety systems will perform their intended function under the worst postulated station electrical fault condition.

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DATE ➤						

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At the close of the meeting, the NRC staff informed the Toledo Edison Company that they would expedite their review and evaluation of the information presented and be in further contact with the Toledo Edison Company on the following day regarding these matters.

H. M. Engle Original Signed by
Leon Engle, John F. Stoiz
Division of Project Management

for
Leon Engle, Project Manager
Light Water Reactors Branch No. 1
Division of Project Management

Enclosures:

1. Attendance List
2. Analysis-Davis-Besse, Unit 1
Station and Instrument
Grounding System

ccs w/enclosures:

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OFFICE ➤	DPM:LWR #1	DPM:LWR #1				
SURNAME ➤	<i>LEON Engle</i>	<i>JF Stoiz</i>				
DATE ➤	9/9/77	9/13/77				

ENCLOSURE 1

ATTENDANCE LIST

AUGUST 25, 1977 MEETING (AFTERNOON)

WITH THE

TOLEDO EDISON COMPANY

DAVIS-BESSE, UNIT 1

DOCKET NO. 50-346

NRC - STAFF

L. Engle
T. Ippolito
F. Jablonski
R. McDermott
C. McDonald
C. Miller
F. Schmeder
K. Seyfrit
J. Stoltz
A. Szukiewicz
T. Tambling
R. Tedesco
V. Thomas
D. Vassallo
P. Wagner

BECHTEL CORPORATION

P. Anas
V. Marathe
B. Novich
L. Wise

BABCOCK & WILCOX COMPANY

R. Donovan
E. Patterson
G. Schieck

SHAW, PITTMAN, POTTS & TROWBRIDGE

G. Charnoff

TOLEDO EDISON COMPANY

R. Bins
C. Domeck
F. Miller
L. Roe
A. Topor

OFFICE ➤						
SURNAME ➤						
DATE ➤						

MEETING SUMMARY

Docket File ←

NRC PDR

Local PDR

TIC

NRR Reading

LWR-#1 File

E. Case

R. Boyd

R. DeYoung

D. Vassallo

J. Stolz

K. Kniel

O. Parr

S. Varga

L. Crocker

D. Crutchfield

F. Williams

R. Mattson

H. Denton

D. Muller

Project Manager: L. Engle

Attorney, ELD

E. Hylton

IE (3)

ACRS (16)

L. Dreher

NRC Participants: L. Engle
T. Ippolito
F. Jablonski
R. McDermott
C. McDonald
C. Miller
F. Schroeder
K. Seyfrit
J. Stolz
A. Szukiewicz
T. Tambling
R. Tedesco
V. Thomas
D. Vassallo
P. Wagner

ENCLOSURE 2

DAVIS-BESSE UNIT 1
STATION
AND
INSTRUMENT GROUNDING SYSTEMS

SYSTEM DESIGN CRITERIA

The station ground grid system at Davis-Besse is a three dimensional grid in the turbine and auxiliary building that consists of 4/0 and 500 MCM bare copper conductor. The vertical risers are installed at a minimum of every other building column. Horizontal conductors are installed as needed to tie equipment to the station ground grid (20' to 70' horizontally). The station ground grid vertical risers are tied to the building steel at each floor as a minimum and the horizontal conductors are tied to the building steel at every other building column as a minimum.

The instrumentation common signal and analog signal cable shields for the following major systems are tied to the instrument ground bus:

1. Reactor Protection System (RPS).
2. Integrated Control System (ICS).
3. Non-Nuclear Instrumentation (NNI).
4. Computer processing unit, local and remote multiplexers, typers, line printer, paper tape punch/reader, card reader, cathode ray tubes and operator keyboards.
5. Miscellaneous electronic control system.

The analog signal cable shields for the following major systems are tied to the instrument ground bus:

1. Safety Features Actuation System (SFAS)
2. Steam and Feedwater Rupture Control System (SFRCS)
3. Steam generator level

The station and instrument grounding systems have been installed in accordance with the Davis-Besse Unit 1 design criteria. During the testing on these systems, the following has been found:

1. RPS, ICS and NNI; the instrument ground buses in these systems are intentionally tied together. There may be an inadvertent tie between this group of instrument ground buses and either the station ground system or the instrument ground bus in the computer or the miscellaneous electronic control system.
2. There is an inadvertent tie between the following instrument ground bus and either the station ground system or the instrument ground bus in another system:
 - A. Computer.
 - B. Miscellaneous electronic control system.

EQUIPMENT DESIGN CRITERIA

The RPS was designed and shipped to Davis-Besse with isolated instrument and station ground systems. The RPS has been used at all B&W units in operation with these two buses tied together in the cabinets and then connected to the station ground grid. The RPS is designed to operate within specifications when installed with a single grounding system or with separate station and instrument grounds as specified at Davis-Besse. The Davis-Besse grounding system meets the B&W balance-of-plant (BOP) requirements for this installation. The B&W BOP requirements stated in the 205 BSAR call for a grounding system similar to that employed at Davis-Besse.

The NNI and ICS were designed to have either single or separate instrument and station ground systems. All B&W units in operation have had the two ground buses in these systems tied together. The NNI and ICS cabinets and interconnecting cables to remote instruments were shipped to Davis-Besse with the two ground systems tied together. This required Toledo Edison to work closely with B&W and Bailey field representatives to modify the equipment to separate the ground buses in these systems.

The computer and miscellaneous electronic control system were designed and shipped with separate instrument and station ground systems.

The SFAS and SFRCS and steam generator level systems were designed and shipped with separate instrument and station ground systems. Only analog signal cable shields are connected to the instrument ground bus. Noise tests conducted by their manufacturer (Consolidated Controls Corporation) indicated that these shields could be connected to either the station or instrument ground system or they could be left ungrounded.

MAXIMUM GROUND FAULT CURRENTS

If a ground fault on any of the major electrical equipment, station power electrical buses or transformers should occur, this fault current would flow through the station ground system. The maximum ground fault current that could occur due to a fault on each electrical system on Davis-Besse Unit 1 is as follows:

1. 345 KV - 21,200, amps.
2. 25 KV Main Generator - 8 amps. Limited by ground resistor.
3. 13.8 KV Housepower buses - 400 amps. Limited by ground resistor.
4. 4.16 KV Housepower buses - 400 amps. Limited by ground resistor.
5. 480 Volt Housepower buses - 21,900 amps.
6. 250/125 Volt DC Housepower buses are ungrounded and no DC fault currents can flow in the station ground grid.

MAXIMUM GROUND CURRENT INDUCED VOLTAGES

If there is an inadvertent tie between the instrument ground system in the RPS and the station ground, loop fault current from an electrical fault could flow in the RPS instrument ground connection producing an induced voltage at the RPS system.

The largest ground currents that can flow thorough the station ground system in the Cable Spreading Room ceiling would be caused by an ground fault in the 480 V Motor Control Center (MCC) located directly above the Control/Cabinet Room at elevation 643'. The maximum ground fault current that can occur at this MCC is 12,600 amps assuming zero ohms station ground system impedance. The source of this ground fault current is a 1000 KVA transformer located on elevation 603' at the northside of the auxiliary building. This 1000 KVA transformer has a 6.75% impedance on 1 MVA base, 13.8 KVA to 480 V, (Delta : Y) transformer with a solidly grounded neutral. The 13.8 KVA bus is assumed to have zero impedance up to the 480 volt transformer.

In calculating this induced voltage that could be impressed on the RPS instrument ground bus, the following conservative assumptions were made:

1. Only 50% of the ground fault current would flow from the MCC to the 1000 KVA transformer on the ground cables installed in the conduits with the phase cables.

2. The station ground grid at elevation 643' is assumed connected to the 1000 KVA transformer by a single 500 MCM uninsulated copper cable which forms a 165' by 40' vertical boundary of the auxiliary building region involved. All the fault current which flows in the station ground is assumed to flow through the Cable Spreading Room ceiling in an East-West direction, and has been taken to be a single 500 MCM cable.
3. No ground fault current would be by-passed through building steel.
4. The location of the inadvertent tie between the instrument and station ground systems was picked in an attempt to maximize the loop currents flowing in the RPS instrument ground buses.
5. A zero voltage drop in the station ground system between the 1000 KVA transformer and the point where the 500 MCM insulated conductor from the instrument ground bus in the Cable Spreading Room connects to the station ground system. This assumption will further maximize the fault current in the instrument ground loop in the RPS cabinets.

Using the above conservative assumptions, the fault voltage that could be impressed on the instrument ground buses would be 1.2 volts, rms, 60 Hz. The ground fault current that caused this voltage would be interrupted within 3 cycles (50 ms.). This 1.2 volt difference between NI/RPS cabinets would cause 60 Hz current flow thorough the system's instrument ground. Normally, this kind of "noise" could enter the system through inductive or capacitive coupling between a ground lead carrying the noise and an analog signal lead. Since the degree of coupling is not known, one can assume an unlikely worst case in which there is direct coupling, with no attenuation, directly into any or all RPS 0 to 10 volt DC analog signals. The system is designed to reject such noise by a minimum of 34 db which translates to a 2500:1 power attenuation or a 50:1 voltage attenuation. With 34 db rejection, the worst effect on a trip set point will be to impose an error of less than 0.24% of the signal full range. However, when the noise is injected in such a way as to pass through one or more modules prior to the bi-stable set point module, additional attenuation occurs reducing the error to less than 0.06%. Considering the assumed direct coupling, the effect is extremely conservative. It is B&W's assessment that this is not a safety concern.

MEETING SUMMARY

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