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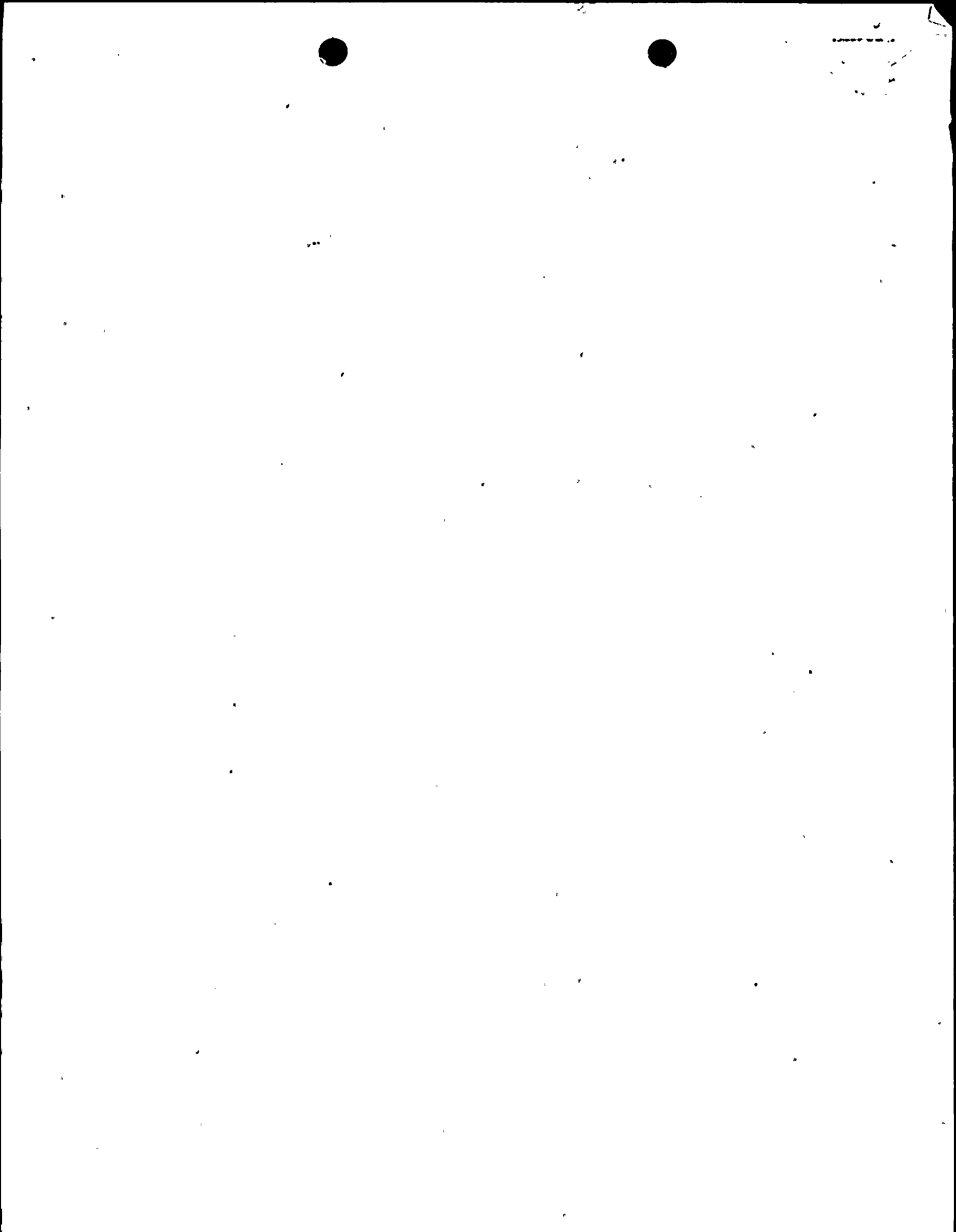
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Docket Nos. 50-352, 50-353, 50-387, 50-388, 50-397, 50-410, 50-416, 50-417, 50-461, 50-462, 50-458, 50-459, 50-440, 50-441, STN-50-518, STN-50-519, STN-50-520, STN-50-521, STN-50-552, STN-50-554, 50-522, 50-523, 50-466, STN-50-556, STN-50-557, STN-50-447

APPLICANT: General Electric

FACILITY: Limerick 1, Limerick 2, Susquehanna 1, Susquehanna 2, WEPSS Nuclear Project 2, Nine Mile Point 2, Grand Gulf 1, Grand Gulf 2, Clinton 1, Clinton 2, River Bend 1, River Bend 2, Perry 1, Perry 2, Hartsville A1, Hartsville A2, Hartsville B1, Hartsville B2, Phipps Bend 1, Phipps Bend 2, Skagit 1, Skagit 2, Allens Creek, Black Fox Station 1, Black Fox Station 2, GESSAR

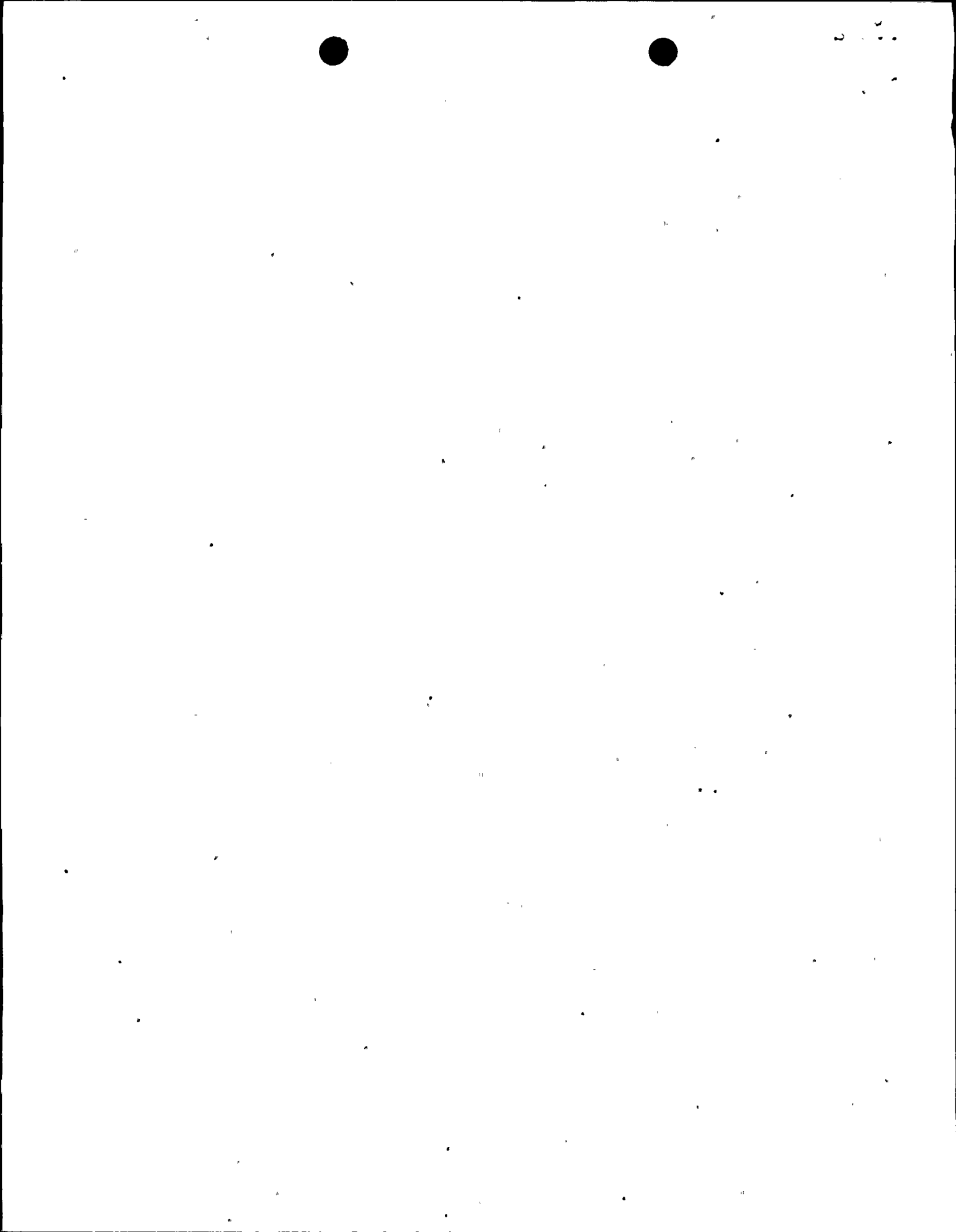
SUBJECT: SUMMARY OF DECEMBER 2, 1977 MEETING CONCERNING NEDO-10466, Rev. 1, "POWER GENERATION CONTROL COMPLEX DESIGN CRITERIA AND SAFETY EVALUATION"

We met with representatives of General Electric on December 2, 1977, to discuss our review of NEDO-10466, Rev. 1, "Power Generation Control Complex Design Criteria and Safety Evaluation." A list of attendees is enclosed.

1.0 Background

On February 29, 1972, we received a topical report from General Electric (NEDO-10466) concerning a factory-assembled arrangement of modules, terminals and panels for the installation of interconnecting wiring of control equipment within the control room. This modularized packaging concept has been named the General Electric Power Generation Control Complex (PGCC). The AEC staff issued a report on June 1, 1972, stating that final conclusions concerning the adequacy of the PGCC design would require a total review by the regulatory staff and the completion of the following activities: (1) development of separation criterion by the AEC; (2) completion of the separation safety guide by the AEC; and (3) completion of an industry standard on separation by an IEEE working group. After numerous meetings with the AEC/NRC staff GE subsequently submitted NEDO-10466, Rev. 1, for our review on October 3, 1977. Our review of this revised report was the subject of the meeting.

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2.0 Purpose and Scope of the Meeting

The purpose of the meeting was to achieve the following:

- An exchange of information between GE and the NRC staff on NEDO-10466, Rev. 1.
- To indicate to GE the additional information necessary for the staff to complete its review.

The scope of the meeting included both the instrumentation and control systems and the auxiliary systems review of NEDO-10466, Rev. 1.

3.0 Summary of Meeting

3.1 Instrumentation and Control Systems Review

3.1.1 Qualification of electrical equipment and components.

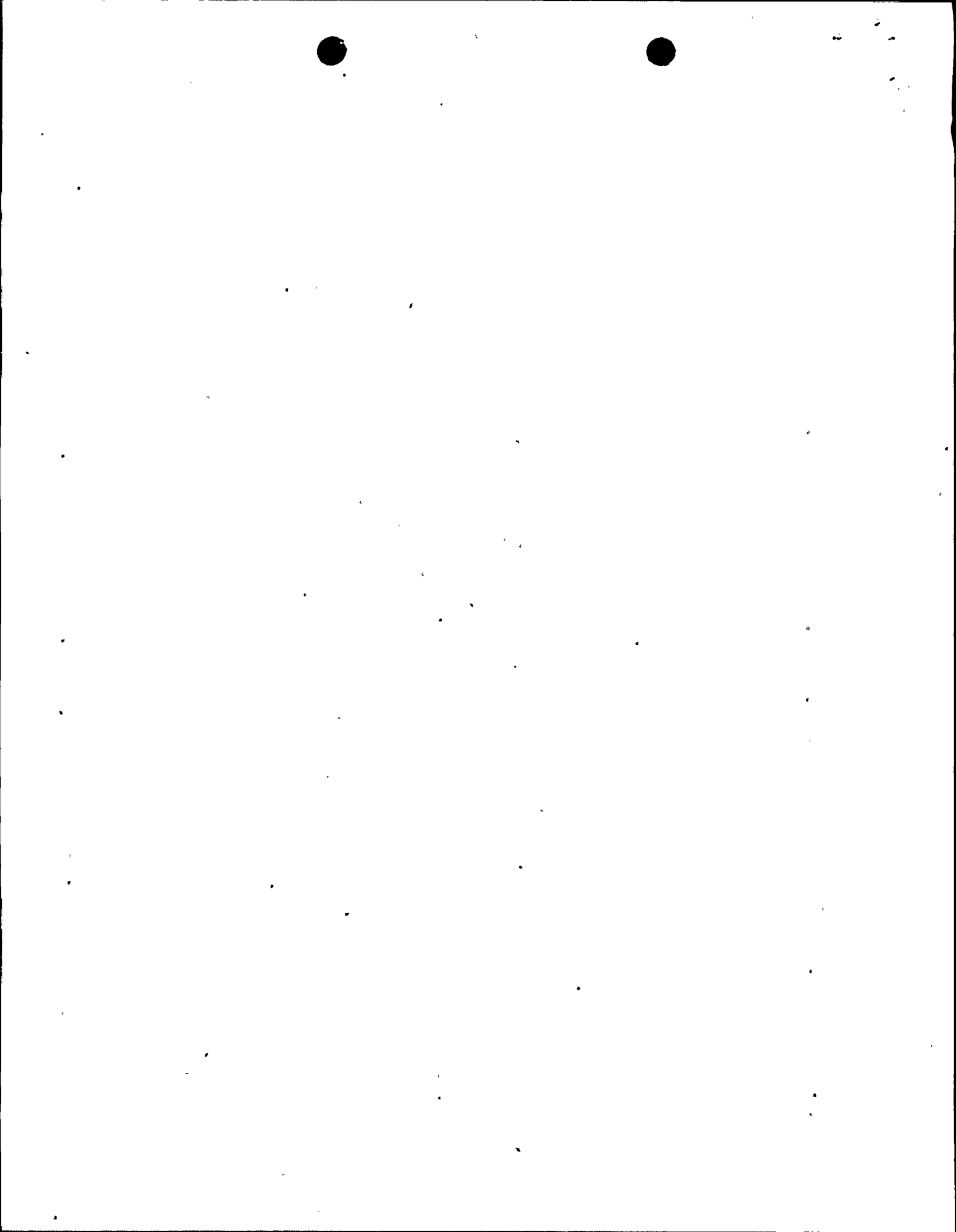
General Electric should add the following information to NEDO-10466, Rev. 1,:

1. An indication of parts of the PGCC to be furnished by GE and those to be furnished by other vendors.
2. Connector and termination devices qualification information. GE agreed to supply a copy of MIL-C-5015 (Reference 4).
3. Additional information should be supplied concerning implementation of IEEE 323-74.
4. In Section 4.2.4.2 it should be indicated that "associated circuits" meet the same requirements as Class IE circuits.
5. In Section 4.2.5.3 a clearer description of the relation between associated cables and Class IE cables should be supplied.

3.1.2 Interfaces

GE agreed to supply copies of References 26 and 27

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3.1.3 Differences - BWR 4/5 vs 6

GE agreed to supply additional clarification on the differences between the BWR 4, 5, and 6 in Section 6.0.

3.1.4 Typical Routing

GE agreed to supply additional cable routing information on cables in cabinets that contain more than one safety related division.

3.2 Auxiliary Systems Review

3.2.1 Disclaimer of Responsibility

General Electric should remove the words "accuracy" and "completeness" from the Disclaimer of Responsibility statement.

3.2.2 General Staff Fire Protection Comments on the History of PGCC

1. GE had a fixed Halon system included in the PGCC Topical Report of 1972. The currently proposed system report does not include such a fire suppression system. BTP 9.5-1, Rev. 1 requires such a system. In addition Regulatory Guide 1.120, Rev. 1 requires under floor protection.
2. In NEDO-10466 Rev. 1, it is stated that no fixed fire suppression is needed for the PGCC.
3. On March 2, 1977, an agreement was signed between Mr. Harry Hendon (GE) and Mr. Vic Benaroya (NRC) which states that:
  - a. A fixed, manual fire suppression system will be installed in PGCC floor sections.
  - b. GE will investigate and recommend a design which will allow the manual, local introductions of a fire suppressant into the floor sections.
4. Tests were to be performed to show that the PGCC design is acceptable to meet the above clauses. These tests were performed in May 1977. The tests confirmed that PGCC having Tefzel would be adequately protected with a fixed system. Other type cables created a problem. The tests would have been needed to qualify the unique barriers anyway.

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- 5. On July 21, 1977 we had a meeting to discuss the preliminary findings. We reiterated that:
  - a. The likelihood of accepting a PGCC without fire detection and suppression would be very remote unless it can be shown that none of the materials used in the PGCC will burn.
  - b. The tests did not indicate that Tefzel doesn't burn. Therefore, to meet the defense-in-depth philosophy, a fixed suppression system is necessary.
  - c. In actual practice there will be some deviations from the configuration used in the test. The presence of coaxial cables, armored power cables, and the effects of carpeting as a floor plate covering has not been determined and we are not ready to make any findings.

3.2.3 Fire Protection Requirements

- 1. BNR 4/5 - a fixed fire suppression system with automatic operation.
- 2. BNR 6 (with Tefzel insulated cable) - a fixed fire suppression system with manual operation.
- 3. GE stated that their tests justified a fixed fire suppression system as not being necessary. GE agreed to reconsider this point in view of the staff requirements.

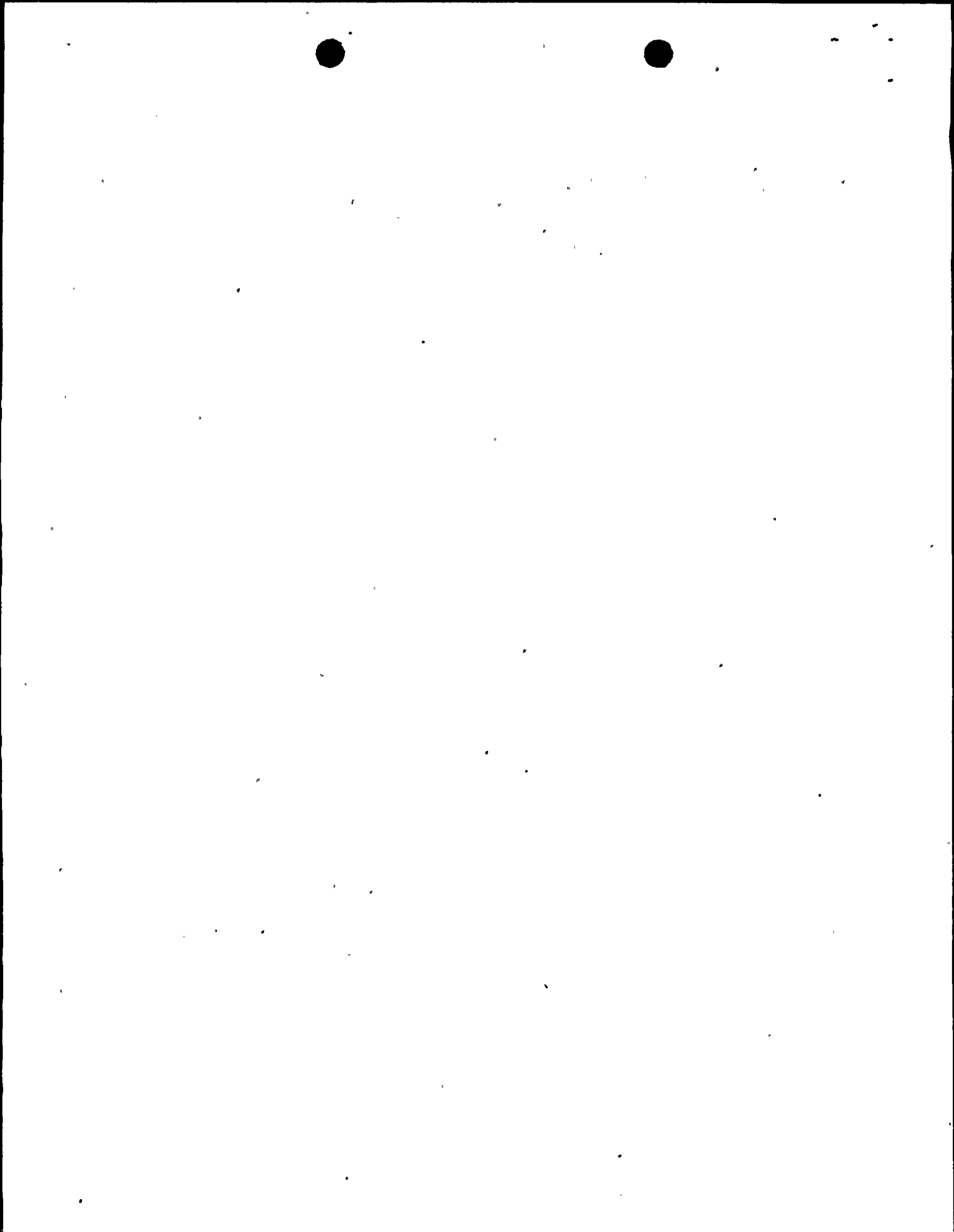
3.2.4 Section by Section Comments on NEDO-10466, Rev. 1

GE should modify each section as appropriate.

Section 3.3.2.3

The configuration of the two right angle clips is not clear; descriptive material and drawings do not cover this. GE clarified the configuration of the clips and agreed to provide a figure.

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With regard to fire tests for carpeting, GE agreed to modify the report to either remove the fire-exposure criteria or more specifically address underfloor-exposure criteria. We informed GE that we are in the process of reviewing carpeting on a generic basis, and may reject carpeting in all nuclear plants as an acceptable floor covering. There may be, however, some justification to accept vinyl asbestos tile as an alternate. GE took this position under advisement.

Section 3.3.2.5

The reasons for omitting a fixed fire suppression system are not valid. Exclusive use is not made of Tefzel (or equivalent) cables. See 6.3.1 comment regarding the health hazard.

GE's position is that a fixed fire suppression system is not appropriate for Tefzel-based designs as shown by their highly successful tests. GE agreed to reevaluate the position or consider appealing to higher NRC management.

Section 3.3.2.6

A better specification or specific brands should be provided: "fire retardant silicone rubber" is a very general term. GE agreed to modify the report to be more specific on silicone rubber specifications. Due to trade restrictions, GE will not specify a manufacturer.

Section 4.2.1.1, 4.2.2 and Appendix B

The overheat possibility only considers normal current flow, not current flow in an electrical fault. Circuit breakers are not perfectly reliable, so overload conditions should be considered. GE agreed to modify the report to include overload conditions in the transient ranges.

Section 4.2.1.4b

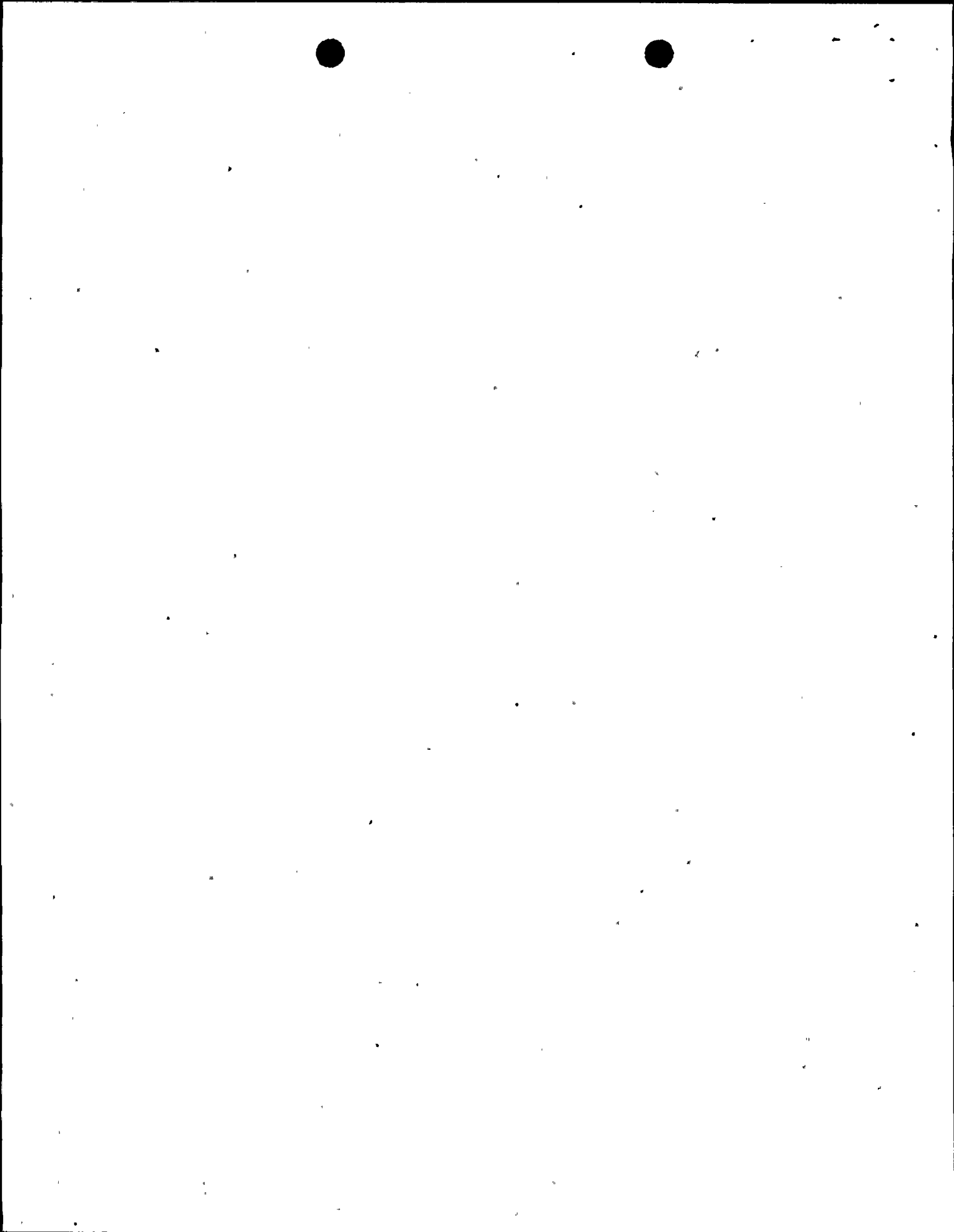
What fire barrier tests were conducted with termination cabinets? No documentation of these tests is included.

GE agreed to revise the report to specify the barrier maintenance and repair requirements.

GE also agreed to include a summary of fire tests conducted on the termination cabinets and provide a copy of the test report.

GE stated that it was their position that the termination cabinets should be treated in the same way that the other control room panels will be treated for fire protection features.

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Section 4.2.1.6

The topic of separation within termination cabinets has not been previously considered. However, it appears the fire risk may be considerably greater there than in the duct.

GE stated that divisional separation is maintained within termination cabinets and that there is never more than one division per bay.

Section 4.2.2, p 13, para 2

There is no assured automatic access to the location of fire in the duct just because a floor plate may be removed. The removed plate may be remote from the point of fire not directly over it. GE agreed to change the word "automatically" (page 13, paragraph 2) to "readily available".

An extinguishing agent will still accumulate in the enclosed duct areas and, since Halon 1301 is several times as heavy as air, it will tend to remain in the duct even when a floor panel is removed. The Halon distribution system could be designed to minimize losses.

The NRC staff's consultant indicated that tests would be run sometime in 1978 to provide data on what percentage of concentration of Halon would be sufficient for deep-seated fires. He also indicated that NFPA is really guidance for surface fires, and in the meantime GE should use a 20 percent concentration to provide protection for deep-seated fires.

Section 4.2.2, p 4-14, para. 3

The discussions of Teffel IEEE 383 test results does not include the test of a full tray conducted at the same time. Information we received indicated that when the test was modified using a full tray, the Teffel cable burned readily.

GE agreed to modify the third paragraph (Page 4-14) on IEEE-383 tests to simply state that the cable meets the criteria.

Section 4.2.2, p 4-11, para 5

Tests at Sandia did not cover high resistance electrical faults which are another potential electrical ignition source. The statement on maximum possible load is not justified (see comments on 4.2.1.1)

GE agreed to investigate a modification to indicate that overload conditions are bounded by the Scandia Tests.

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Section 4.2.6

Smoke and toxic combustion gases are a concern for 2 minutes but Halon 1301 is a concern for 8 hrs. (per 6.3.1). There seems to be an inconsistency.

V. Benaroya (NRC) commented that Regulatory Guide 1.78 was not appropriate for the scope of the PGCC. Since the overall control room habitability is within the utility applicant's responsibility, GE agreed to modify this section to delete the 2-minute toxicity requirement.

Section 6.3.1

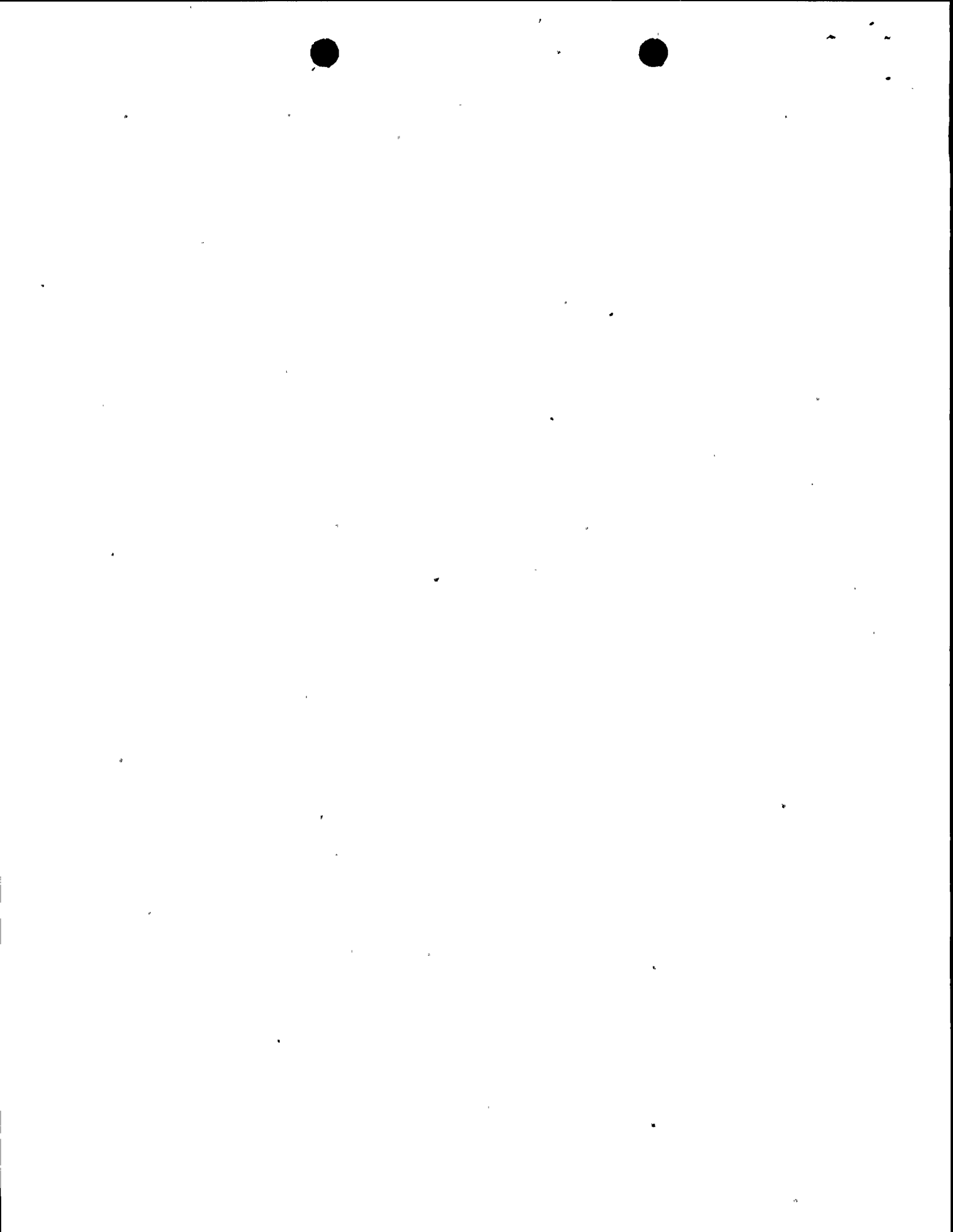
The 5% Halon design is not necessarily adequate to extinguish a deep seated fire.\* The statement that concentrations over 10% are not permitted in normally occupied areas does not apply since the duct is not a normally occupied area. The ACGIH limit of .1% for 8 hours exposure to Halon 1301 is also used as a reason for limiting the Halon 1301 concentration. It is not clear whether this limit is based on an 8 hour day, 40 hour week continuing exposure or on 8 hours emergency exposure? Regardless of the limit, it would appear the consequences of radioactive releases far outweigh a standard such as this. If the fire is not quickly suppressed, the residual Halon 1301 will be of relatively minor significance. In addition, the Halon 1301 would be concentrated in the ducts and it would be a long time before it diffused throughout the control room.

However, if Halon 1301 is of such a concern, there are other fire suppression agents such as water.

A surface fire is defined as a fire in which only the outer surface of material is heated above its ignition temperature; combustion would be largely in the vapor phase. A deep seated fire is defined as one in which much of the combustible is heated above its auto-ignition temperature; combustion occurs in both the solid and vapor phases. There is no line of demarcation between the two types of fires. NFPA standards arbitrarily and somewhat circularly define a surface fire as one that can be completely extinguished by 5% Halon 1301 within a soaking time of 10 minutes.

\* The quantity of Halon 1301 or other gaseous agent required to suppress a fire depends on the combustibles involved and whether it is a surface fire or a deep seated fire.

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A Halon 1301 system which would only extinguish surface fire is reasonable if reasonable if either:

1. Deep seated fires will not occur with the type of combustible material present

or

2. The fire detection system will provide early warning and will actuate the Halon system before a deep seated fire can develop.

Neither of these are judged valid for cable spaces.

Tests have shown that thermoplastics in some configurations did not produce deep seated fires. However, in cable fire tests glowing combustion has been observed which is characteristic of a deep seated fire. In addition, rubber base materials do produce a deep seated fire; some cable insulations are of synthetic rubber base materials. A deep seated fire involving a transient fire load is also possible.

Limited test data indicates a 20-30% concentration of Halon 1301 is necessary to extinguish deep seated fire in cellulosic materials. There is no data on deep seated fires in rubber or polymeric materials. Although the design assumptions of the Halon 1301 systems may not be confirmed, there is experimental data to indicate that this fire extinguishing system may contain or retard a deep seated cable fire and any transient load fire. Fire tests in simulated aircraft cargo compartments have shown that 3 1/4% Halon 1301 will suppress flaming combustion and retard deep seated combustion sufficiently to keep the temperature below 400 F for about 2 hours. Other tests have shown that 3-5% Halon 1301 will suppress flaming combustion in fires involving cellulosic materials although it would not suppress deep seated glowing and smoldering combustion even with long soaking times.

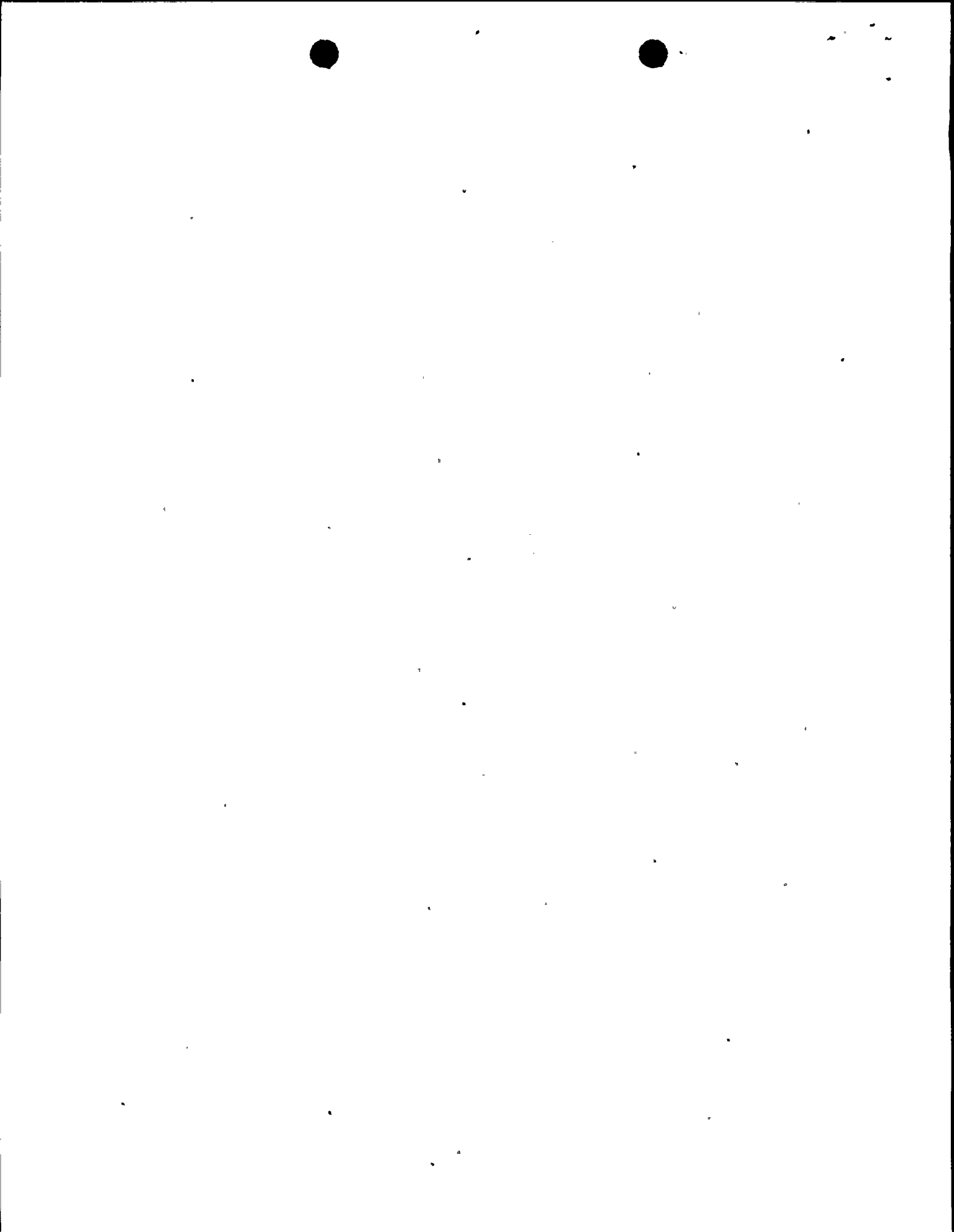
GE agreed to investigate the percent halon concentration and revise the report with a more appropriate number. GE also agreed to revise the first paragraph on Page 6-2 to indicate there is no problem with decomposition since the fire temperatures would in reality never reach decomposition temperature (i.e., use the actual test results to show no problem). Additionally GE will add some comments regarding Regulatory Guide 1.1.20 to indicate that the cable is capable of being wetted down.

Sections 4.1.6 and 4.2.6

These sections should be deleted because they are outside the scope of the report.

Appendix C

The "Fire Hazard Analysis of the PCCC Floor Section" should be replaced with test results information.				
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4.0 Conclusions

General Electric has agreed to respond to all the above staff comments. Based on this agreement the staff will not issue formal questions but instead use this meeting summary as the official transmittal of staff questions. On December 3, 1977 GE phoned to get more guidance on an installed Halon suppression system. The staff informed GE that an acceptable concentration was 20% with a 20 minute soak time. The staff also informed GE that the GE test to be performed Friday December 9, at Berkeley, should be performed with a tile covering installed on the floor plate over the fire to achieve test results more closely resembling the installed system.

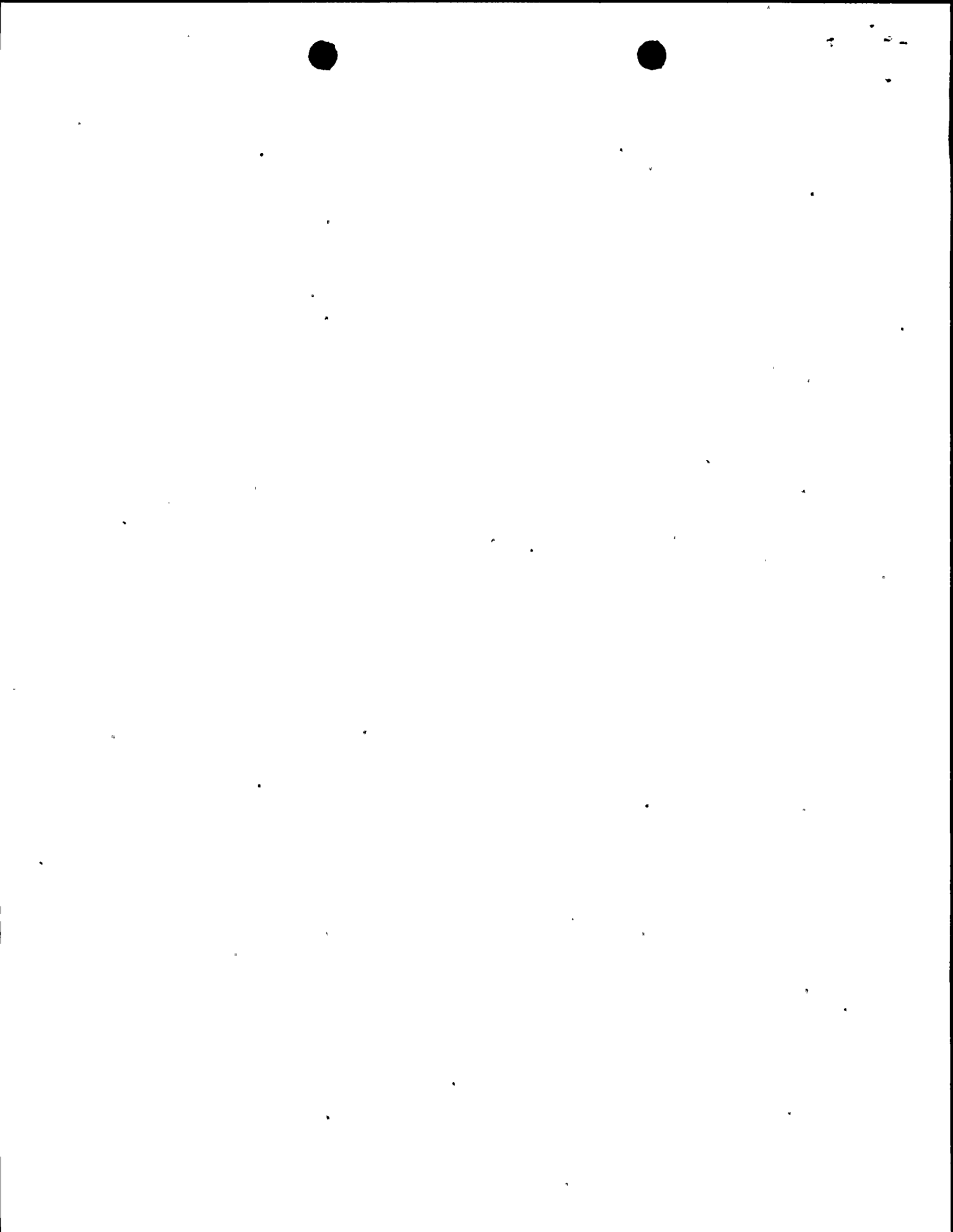
Original signed by

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Enclosure:  
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cc: See next page

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50-522/50-523  
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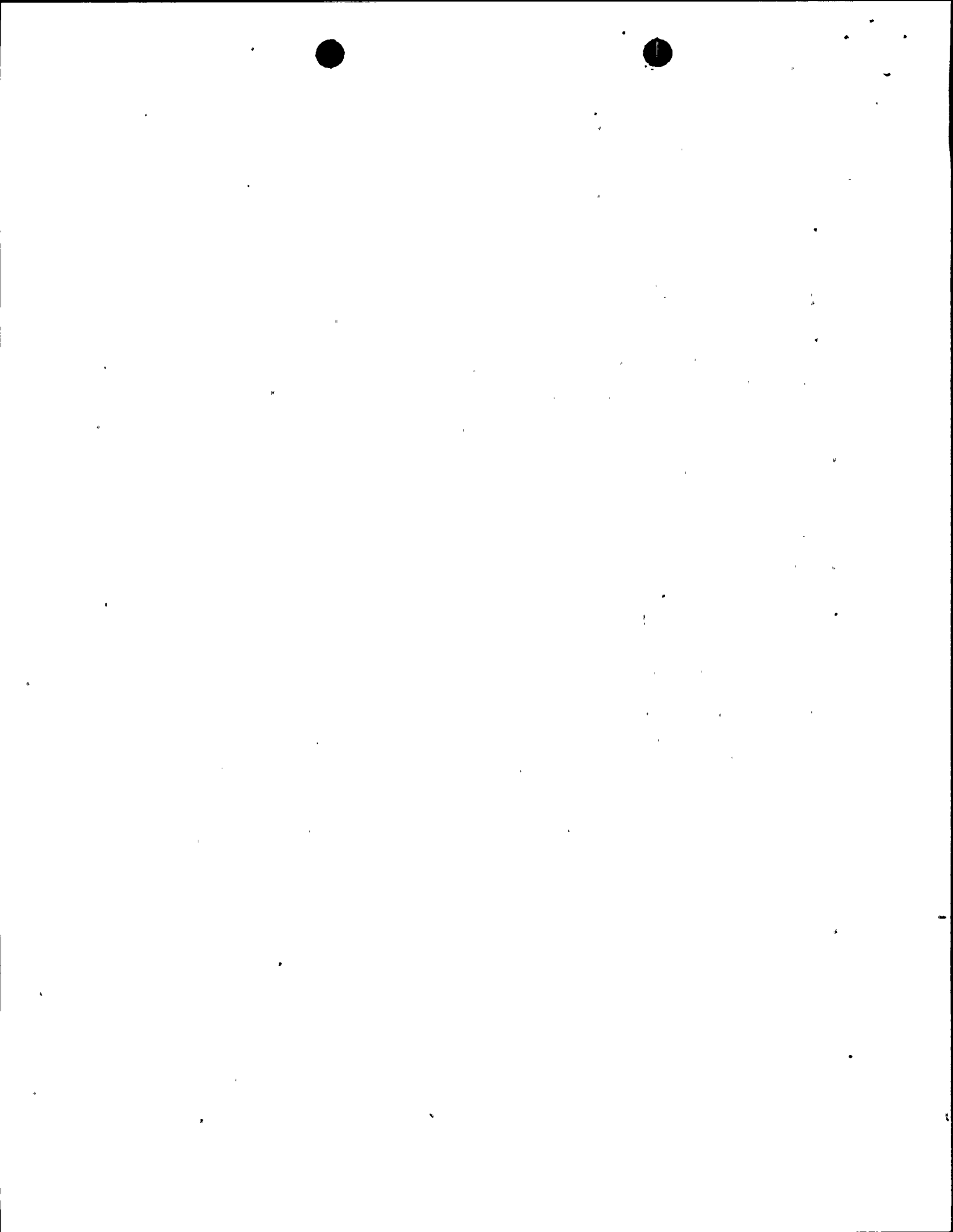
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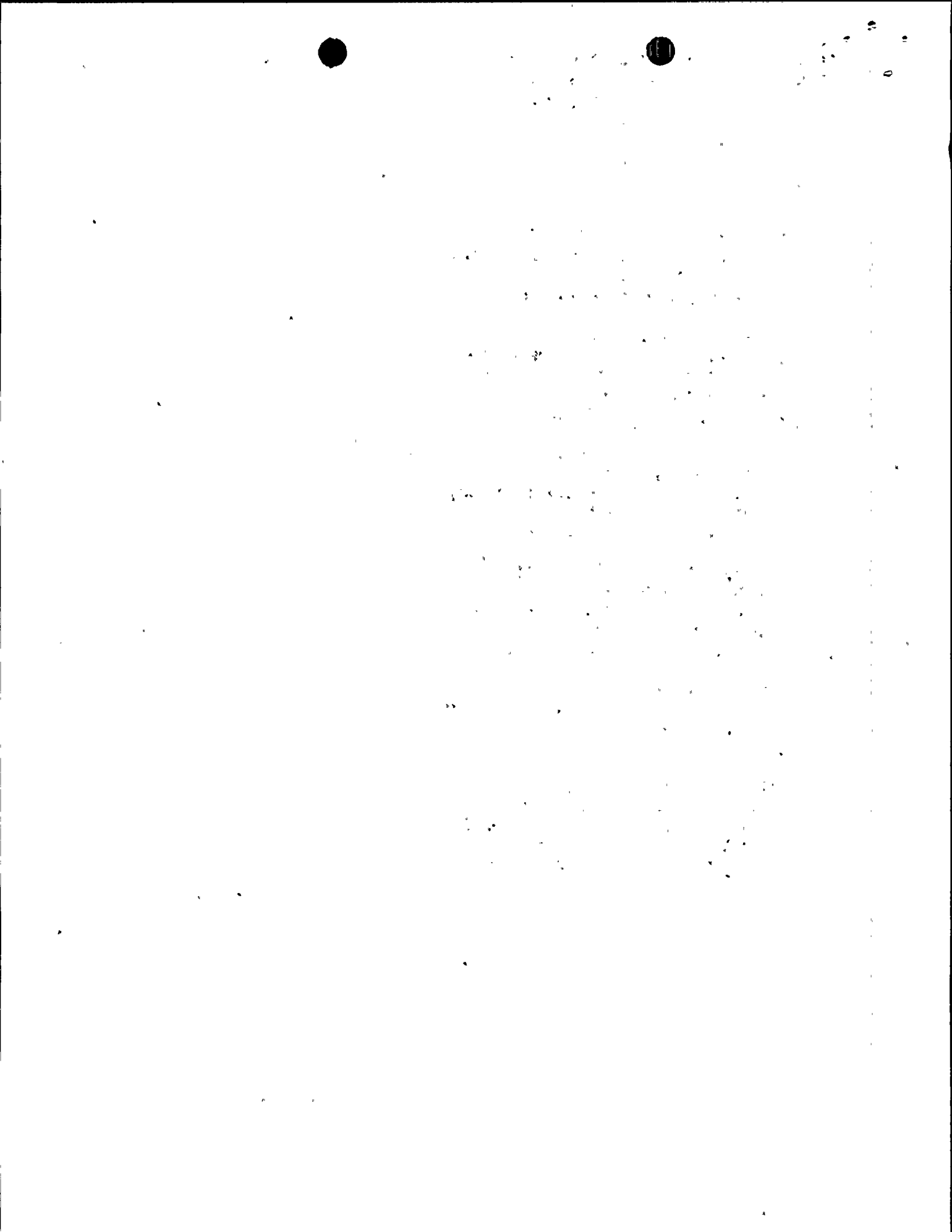


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