[redacted]

FROM (NAME – LOCATION – PHONE) [redacted] Corporate Engineering - [redacted]

DATE : April 30, 1984 CC:

SUBJECT : TRANSFORMER FIRES

REFERENCE :

TO : [redacted]

I have been with [redacted] thirty-three years and during this time I have been closely affiliated with electrical utility systems in many of the [redacted] plants. I have never heard of a transformer fire within a [redacted] facility, but we have had transformer failures.

Some of those that come to mind are as follows:

In the 1970's the tap changer compartment of the regulating transformer for the [redacted] line at [redacted] exploded twice, no fire.

The tap changer compartment of a brand new [redacted] regulating transformer in the main substation at [redacted] plant blew open in the mid-1950's. Large quantities of oil came out, but there was no fire.

In the 1950's we had two PCB transformers at [redacted] plant fail. Their tops were ripped off. One was a 3,000 KVA transformer feeding [redacted] and the other was a 500 KVA transformer feeding the [redacted] boiler, no fires.

Attached are some recent Incident Reports from the [redacted] plant. Three of these show transformer failures.

The transformer failures we have had were due to moisture related insulation failures or to mechanical stress insulation failures. There is no reason ever to have a transformer fire if there is coordinated protection on the feeders supplying the transformer's primary. Large transformers should have a sudden pressure relay. The slightest pressure ripple in a transformer will cause this relay to function and to trip the circuit breaker for the circuit supplying power to the transformer. Of course, all transformers are not protected by circuit breakers and a sudden pressure relay cannot be used, but where fuses are used they should clear the transformer before a serious fire occurs.

The utility companies on their downtown distribution networks use current limiters or in some cases practically no protection. When a transformer fails, all the energy in the system rushes to the point of the short circuit. This terrific concentration of energy is going to cause significant destruction unless the damaged equipment is cut off from the system quickly by the protective devices. Instead of OSHA coming up with additional requirements on everybody, they should make the electrical utilities comply with the National Electrical Code. Their coordinating practices on all their distribution systems overhead and underground are poor. Their high voltage systems do have quality protection.

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PCB filled transformers are much more subject to failure than are oil filled transformers. In oil filled transformers moisture accumulates at the bottom of the tank below the electrical winding. For PCB transformers, the moisture floats on top of the PCB, and the electrical windings have to go through this moisture interface to exit the transformer. Also, this top moisture promotes rust which falls into the electrical components and cause shorts. (This was the case of the two PCB transformers which failed at [redacted].) PCB needs a much higher degree of maintenance. It is rare that transformer bushings fail and it is very rare that thru faults on equipment down stream cause transformer failures <u>if the transformers and feeders are properly protected</u>.

For maintenance, most of the [redacted] foremen walk their facilities and make a visual inspection of the transformers once a week. They also take oil tests on a six-month or yearly basis and have contract companies come in to filter the oil or PCBs, when necessary. An important factor is that in industry we keep track of the loads on our transformers and we do not indiscriminately add blocks of load which can overload the equipment. This can occur in a high-rise building quite easily when a fuse blows and they put in a fuse of larger capacity. Utilities usually keep track of their loading also. If a customer already had a large service entrance in his facility, he could conceivably add load without consulting the utility company and there could be a potential problem.

In summary, within [redacted] we consider a transformer a very reliable piece of equipment. We have had oil and PCB filled units in operation for twenty years with minimal maintenance or expense. There was a transformer bank (oil) in the [redacted] plant that ran twenty-five years with no maintenance and no problems. I do not think that any additional restrictions should be put on industry for PCB or oil filled transformers. The restrictions should be put on the poor performers - the utility and commercial facilities. Our track record is excellent, we do a quality job now and any additional regulations will not change our practices, but may result in additional paperwork.

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