RESTORATION PLANNING PRIOR TO POSSIBLE WATER DAMAGE TO CENTRAL OFFICE AND PBX EQUIPMENT

CONTENTS PAGE

1. GENERAL 1

2. ACTION AT OFFICE OR PBX WHERE WATER DAMAGE THREATENS 1

3. HEADQUARTERS ACTION 3

A. Developing Restoration Plans . . . 3

B. Providing Emergency Equipment and Supplies 3

C. Alerting Western Electric Company and AT&TCo 5

4. EFFECTS OF WATER DAMAGE ON EQUIPMENT 5

5. CONSIDERATIONS TO PRECLUDE WATER DAMAGE 6

A. General 6

B. Site Selection 6

C. Design Factors to Minimize Water Damage 7

D. Consideration of Flood Hazards at Existing Buildings 7

1. GENERAL

1.01 This section covers restoration planning prior to possible water damage to central office and PBX equipment. The section also covers the general plan for abandoning a central office or PBX due to rising water. This section contains information previously covered in Section 069-392-800 and Section 167-790-811 which have been canceled.

1.02 Water damage to buildings, central office and PBX equipment may result from a variety of different causes. Among them are floods, defective plumbing, rain or snow entering windows, ventilation or temporary building openings, fire fighting efforts, etc.

1.03 Restoration of water-damaged central office and PBX equipment is a matter calling for the closest cooperation among departments. Clear-cut lines of authority should be established, particularly where these may cut across normal organizational interfaces.

1.04 It is suggested that those who may supervise or otherwise participate in restoration work be familiar with the information in this section and local disaster plans so that service interruptions due to emergencies may be minimized as much as possible. The members of the emergency team should be thoroughly briefed on their responsibilities and duties, and should engage in periodic "refresher" activities.

1.05 The importance of thorough planning cannot be overemphasized. Thorough planning and organization before a water-damage emergency can materially reduce the time required to restore service.

2. ACTION AT OFFICE OR PBX WHERE WATER DAMAGE THREATENS

2.01 There are a number of local administrative steps that should be taken well before a flood threatens to hit. Vulnerability of all central offices should be appraised. Results of the appraisal will indicate priority and the extent of administrative planning needed. Experience suggests that the appraisal and the preparation of a detailed plan for each office be the responsibility of the office supervisor, together with the plant staff and

engineering people. The following should be considered in making detailed emergency plans:

(1) Determine the kind of progress reports to be issued, how often they are to be issued, and to whom they should be issued.

(2) Organization chart to show clearly-defined individual responsibilities during emergency. The chart should list the personnel responsible for specific operations when abandoning or recovering the central office or PBX.

(3) Current call-out list of employees and supervisors, together with an alternate list.

(4) Trained operators for emergency switchboards.

(5) Battery powered radio to check flood developments.

(6) Procedure for allocating equipment necessary for flood control.

(7) Contour map of the surrounding area showing the best access routes.

(8) Employee instruction to take office records to safety if a flood threatens. Posted memorandum notices may help.

2.02 Primary and alternate sources of material and equipment should be known. Some of the needs will be:

(1) Sandbags and barricades.

(2) Boats.

(3) Water pumps.

(4) ***Emergency power equipment.*** Since many power rooms are on the first floor or in the basement, office standby power generators are usually among the first to be flooded. ***Large portable emergency generators will be needed immediately in such cases.***

(5) Boots, buckets, mops, brooms, and hoses.

(6) Cans for carrying water and garden tank-type sprayers for washing down equipment.

(7) Heat lamps, "bonnet" type hair driers, construction heaters, fans, nylon bristle brushes of various sizes, hair dryers, blowers, etc.

(8) Clean fresh water. It is very important that plenty of clean water is available for flushing the equipment. Some pumping facilities may be needed to force water to equipment locations. Some tank trucks are not equipped with pumps. Pressure on the order of 25 pounds per square inch—"garden hose" pressure—will be required.

(9) Portable air compressors are likely to be needed for blowing off surface water.

(10) Food, drinking water, blankets, etc.

(11) Transportation for material and people.

(12) Where an office is in a potential flood area, standing arrangements should be made with local tank truck operators and/or the fire department to supply clean water when needed. Similar arrangements may also be made for portable or trailer mounted engine alternators, etc. It is suggested that a list of the firms involved be maintained at both the local and district offices.

(13) Emergency Communications Center or Message Center.

2.03 Local electrical contractors can be of great assistance. They usually are able to quickly furnish wire, switches, and hardware that may be necessary.

2.04 Plans should be made to have rectifiers and batteries available in the event of an emergency. If spare rectifiers are not available, it is recommended that extra units of the various voltages be installed at designated locations in an area where they can be disconnected and transported on short notice. If new rectifiers must be ordered from the manufacturer, restoration may be delayed.

2.05 Reconditioning or replacing the ringing equipment can easily prove to be a controlling factor in power restoration. Spare ringing plants are not generally available and a new ringing plant may be the only alternative. In view of this, consideration should be given to obtaining an

emergency ringing power plant. The portable 804D Emergency Ringing Power Plant, for example, is intended for emergency use with No. 1 and 5 Crossbar Systems, No. 1, 350A, and 355A Step-By-Step Systems, No. 11 Manual System and the Panel System when the existing ringing power plant has failed.

2.06 The basic plan may need periodic review to be continuously applicable. If properly applied this plan should ensure efficient use of manpower and material in these emergencies.

2.07 ***All possible steps should be taken to prevent water from entering buildings. This includes sandbagging, sump pump, use of plank barricades, if provided, and any improvised means that might be effective.***

2.08 ***If it becomes necessary to abandon a central office or a PBX due to rising water, it is extremely important to de-energize the equipment before contact with water. This is to prevent damage to both switching and power equipment due to electrolytic corrosion. The general plan for abandoning an office is given in Table A.***

2.09 Office drawings, assignment records, cable books, and line cards are extremely valuable records. Every reasonable effort should be made to move them to a location above likely water levels.

3. HEADQUARTERS ACTION

3.01 ***Initial appraisal of damage to equipment to determine whether reconditioning is possible or replacement is necessary is probably the most critical phase of the service restoration effort.*** The appraisal should be thorough. It should usually be made, as early as possible, by a team of experienced plant and engineering people. It may be helpful to consult AT&TCo and BTL engineers if the problem is a major one.

A. Developing Restoration Plans

3.02 While the damage appraisal is being made, various service restoration alternatives should be explored. Among the items for which plans should be made are:

(1) Provision for urgently needed toll circuit connections to points outside the disaster area. Magneto toll stations may be used for outgoing calls.

(2) Provision of emergency service to vital organizations such as the military, civil defense, fire and police departments, hospitals, etc. Mobile radio, PBX switchboards, manual switching equipment, telephones located in strategically placed outdoor booths, etc, may often be used to good advantage to quickly establish vital communications for essential organizations and for emergency public use.

(3) Provision for replacing equipment in case the inundated equipment is irreparably damaged and can not be reconditioned. While most of a frame may be restorable, certain types of individual components may be so difficult to dry out that it is best to replace them on the frames. Provisions for obtaining replacement components should be made. In extreme cases service may be re-established by use of temporarily installed manual switchboard or mobile CDO equipment until the damaged equipment can be reconditioned.

(4) Provision of an adequate personnel force to recondition the central office or PBX equipment.

(5) Provision of water, food, and shelter for those working in the flood area.

3.03 Civil defense windshield stickers, permits, etc, will be required to gain entry to most disaster areas.

3.04 As soon as the appraisal of damage to the equipment is completed, the restoration plan should be formulated. The office should be restored partially if possible, in order to provide limited service. The plan should include and designate the part of the office that is to be restored first.

B. Providing Emergency Equipment and Supplies

3.05 To reduce restoration time, an area equipment availability survey should be made. Thus, equipment that may be used if necessary in a water-damaged office or PBX can be spotted for

TABLE A

PLAN FOR ABANDONING CENTRAL OFFICE OR PBX DUE TO RISING WATER

STEP	ACTION
1	Remove all main discharge and associated alarm fuses.
2	Stop charging equipment.
3	Remove intercell connectors of battery strings to reduce voltage available for effecting dc discharge through flood water. Proper protective gloves and insulation against the voltage of the battery string is required. DO NOT OPEN ANY INTERCELL CONNECTORS until load has been removed. To do otherwise could result in a hazardous flash as the connection is opened.
4	If an office is equipped with an automatic start emergency engine generator, disable the automatic start feature to prevent starting when (5) is done.
5	Disconnect ac feed to power plant charging equipment.
6	Fill the batteries to the top with electrolyte, if available, or just clear tap water—this will help exclude contaminated water from the cells.
7	Instruct distant office or PBX to open all trunk cable pairs associated with this office.
8	Transfer all removable equipment to a safe place.
9	Remove 70-type fuses if time permits. It is not necessary to remove 35-type fuses.

Note: A list of appropriate local instructions should be placed in a conspicuous place to cover the previous operations in offices vulnerable to flooding.

quick shipment. The survey should include a review of spare equipment in working offices, equipment being installed or in transit that may be diverted to damaged offices or PBXs, mobile manual or step-by-step equipment, equipment held in storage in the area or at the distributing house, and that stored for emergency use. A list should also be prepared of those items known to be non-repairable. These are generally units in non-hermetically sealed cans that once flooded, cannot be effectively dried.

3.06 It is suggested that shipments to emergency areas be addressed to a particular person and department. Shipments to "Telephone Company" are subject to delay while requisitions are checked.

3.07 New equipment required in addition to that from sources just enumerated should be ordered from the Western Electric Company on an emergency basis. It is essential that all equipment, cabling, apparatus, etc, required be ordered as soon as specific needs are known or anticipated. Care should be taken in ordering to prevent overlooking miscellaneous items. Battery operated test equipment should be ordered complete with batteries.

3.08 Additional equipment very likely to be required includes emergency power equipment, heat lamps, psychrometers, thermometers, air compressors, hair dryers or equivalent, fans, and water supplies. Local contractors may be able to provide arc welding sets to recharge batteries and power generating equipment to operate heat lamps, fans, etc. Local contractors may also be able to pump water out of flooded buildings, clear out mud and debris, build frames for heat lamps, install temporary wiring, make emergency repairs to buildings, etc.

3.09 There are a number of tools not normally used in central offices that will be very useful in an office being reconditioned after a flood. These include: 6- and 8-inch adjustable wrenches, 7-inch lineman pliers, various screwdrivers, hammers, etc.

3.10 An adequate number of fuses should be ordered, particularly the 35- and 70-type, since a number of fuses may operate during the course of restoration.

3.11 The wiring diagrams, schematic drawings, and circuit description sheets covering all equipment to be reconditioned, installed new or transferred from another location, should be sent to the damaged office or PBX for use by installation and maintenance people.

3.12 Included in the orders placed on the Western Electric Company in water-damaged equipment cases, might well be one for additional copies of necessary office drawings and Bell System Practices for use both at headquarters and at the damaged office or PBX.

3.13 Test sets, test cabinets, tools, meters, etc, are required in relatively large quantities during restoration work. Establishment of an area or company emergency stock of these items is a worthwhile insurance measure.

C. Alerting Western Electric Company and AT&TCo

3.14 The Western Electric Co. distributing house serving an area in which a water-damage emergency threatens or exists should be contacted so that necessary personnel may be made available to process emergency orders.

3.15 The Western Electric installation organization should be apprised of an emergency so that necessary installation forces may be dispatched as required to damaged offices.

3.16 When special engineering assistance is required, the AT&TCo Engineering Manager—Equipment Maintenance should be contacted. This in no way voids the customary plant emergency reporting plan.

4. EFFECTS OF WATER DAMAGE ON EQUIPMENT

4.01 ***Corrosion:*** Three forms of corrosion may be encountered on equipment subjected to flooding conditions.

(1) Electrolytic corrosion occurs when anodes and cathodes are present in an electrolyte as supplied by the flood water and a direct current flows. This is often the most serious corrosion and may necessitate replacement of equipment. It results from water coming in contact with energized equipment or reapplying power to equipment that is still wet.

(2) Chemical corrosion occurs when metal is exposed to moisture. This type of corrosion does not require a current flow and is speeded up when the moisture contains salts such as those present in sea water and sometimes in floodwater.

(3) Galvanic corrosion occurs when two dissimilar metals either in direct contact or connected electrically are exposed to an electrolyte. The current which flows in this case is similar to the action of a battery.

4.02 ***Electrolytic Corrosion:*** Energized equipment will be subject to electrolytic corrosion of metallic parts if exposed to excessive surface moisture. The corrosion products are salts of metal which generally form very quickly. They usually form in large amounts and are frequently found in localized areas of component surfaces. The concentration of these products depends on time, potential, and the amount of salts in the flood water which acts as the electrolyte. Concentrations are greatest at points where current leaves metallic parts and less severe at other points on the same parts. Color of the products depends upon the metal being corroded. Anodic or positively charged metallic parts are the most severely affected and may actually be corroded through, while negative surfaces show little if any effect. When the electrolyte (moisture) and/or potential are removed, the electrolytic corrosion process generally stops. Severe electrolytic corrosion damages affect equipment beyond repair within minutes. When electrolytic corrosion occurs, the ions formed may drastically reduce the insulation resistances of older types and other kinds of insulation that absorb water. Wire in relay and magnet coils is reduced in cross section and will likely result in an open when potential is applied. Generally, equipment seriously affected by electrolytic corrosion will have to be replaced.

4.03 ***Chemical Corrosion:*** This corrosion may generally be distinguished from electrolytic corrosion because products of chemical corrosion are much more uniform over the corroded surface. Corrosion without electrolytic action seldom is severe enough to be service-affecting. Zinc, commonly used as a finish for switch castings,

mounting plates, etc, is particularly subject to this condition. Whitish deposits, basic zinc carbonate, are often found on zinc-coated parts when they dry out.

4.04 ***Galvanic Corrosion:*** Corrosion products may form on base metal springs or supports around their junctions with noble metal contacts due to galvanic action. Examples of noble metal contacts are No. 1 metal, which is an alloy of gold, silver, and platinum, and No. 2 metal which is palladium.

4.05 ***Contact Contaminations:*** Base metal contacts are used on step-by-step banks, commutator segments, and commutator wipers. This type of contact is also used on panel banks, sequence switches, selectors, etc. Unless electrolytic corrosion has occurred on base metal contacts, forcing replacement, normal cleaning procedures will generally be effective after water damage. Usual cleaning procedures will be effective to remove dirt, lint, and loose corrosion products lodging on noble metal contact surfaces. Removal of galvanic corrosion products around noble metal contacts is covered in Section 010-120-011.

4.06 ***Swelling of Insulators, Panel Cork Rolls, etc:*** Insulators, spool heads, panel cork rolls, and other materials containing fibrous fillers will swell as water is absorbed. They will partially or fully contract as they dry out. Loose spring pileups may result in some cases. Panel cork rolls will probably need to be replaced because they cannot quickly be dried to the point where they will contract to their original dimensions and remain free from warpage.

4.07 ***Open Coil Windings:*** Open relay and magnet coil windings may occur due to electrolytic corrosion when equipment is re-energized if moisture has not been sufficiently removed.

4.08 ***Silt and Debris:*** Flood water is generally heavy-laden with silt which is deposited as the water velocity is reduced. It usually contains fine binding particles of clay which are nearly impossible to remove from equipment by flushing if allowed to dry. Debris lodges in multiple wiring, cable forms, inside relay covers, etc. If it is not thoroughly removed, it will continuously sift out and produce contact contamination after the equipment is dried.

4.09 ***Relay Insulation Breakdown:*** There is a probability of relay failure due to insulation breaking down to form permanent shorts to ground in wet relays subjected to inductive voltage spikes. These breakdowns are internal to the relay base and are irreversible in nature. Such relay failures may delay recovery of circuit performance beyond the time that would have been required to insure adequate drying of the equipment.

5. CONSIDERATIONS TO PRECLUDE WATER DAMAGE

A. General

5.01 This part pertains largely to buildings and necessarily centers around the concept of precluding entrance of water into buildings rather than of what to do after water damage. The work of the building engineer begins almost at the inception of a central office project or the placement of a PBX. By the time the building is erected the bulk of his work is done as far as protecting the office from flooding is concerned.

5.02 Experience during serious floods has demonstrated that sizeable central office buildings (those larger than community dial offices) survive most flood conditions with little or no structural damage. The usual reinforced concrete or steel frame construction, designed for heavy floor loads, has sufficient sturdiness and stability to come through most flood situations comparatively unscathed. This assumes that there is no undermining of footings or damage from battering wreckage which could create a variety of problems too diverse to treat here and which would require individual solutions in each case. Repairs to water-soaked plaster and flooded heating, ventilating and electrical equipment are all within the experience of building engineers and contractors, and require individual treatment to fit each specific case. Basement walls should be checked to determine whether water soaking has weakened them, particularly those of masonry which are not cast-in-place.

B. Site Selection

5.03 Proper site selection is of fundamental importance in avoiding central office flooding. It is necessary to study the topography of a proposed site and its neighborhood in the light of past experience and assuming a 50 or 100 year storm with associated rainfall runoff and flooding. U. S. Army Corps of Engineers, U. S. Coast and

Geodetic Survey State and local hydrological data should be evaluated before final selection is made. These sources of information, however, should be used as guides only. There will probably be cases where a location a short distance away from the actual wire center can justify the additional cost of outside plant or an increased cost of land by reducing or even eliminating a flooding hazard to the building. It is often helpful to inquire about local flood experience through long time residents of the neighborhood when selecting a building site.

5.04 The importance of prudent site selection has been graphically illustrated in several cases where quite new dial central offices were severely flooded while the former manual buildings, a short distance away on higher ground, suffered no damage.

C. Design Factors to Minimize Water Damage

5.05 In cases where, for topographical or other reasons, it is not practicable to avoid a degree of flooding hazard, there are a number of building design features and other precautions that will assist in preventing entrance of water into a building and minimize the probability of damage to cables and equipment if it should enter. Some of the most important are:

(1) Consider omitting a basement where there is danger of flooding, particularly if costs of the following items in this tabulation are excessive. If a basement is necessary, a thorough waterproofing job is in order, eliminating or minimizing the number of window and door openings to the basement and adequate protection of those that remain. (e.g. in one case where an outside stair well to the basement was necessary, it was enclosed by a water-tight housing and provided with an inward opening marine bulkhead type door at grade). Also, provide a sump for installation of permanent or portable pumps at the lowest basement level.

(2) Consider raising the first floor level several feet above grade if this will elevate the floor above probable flood level.

(3) Consider locating the house service panel, gas turbine engine alternators power, and other common equipment on the upper floors.

(4) All air intake or vent openings through the walls of the building need to be high enough above grade to be well above any probable flood levels. This applies to such items as diesel or gas turbine engine air intake and exhaust, intakes and exhausts for ventilating equipment, and cable vault vents.

(5) Consider eliminating or minimizing the number and size of first floor windows. Avoid low window sills. In exceptional cases, plank barricades for both windows and door openings may be helpful. These can be made quite tight, but are difficult to handle and store, limiting their usefulness.

(6) If a basement is provided, consider elimination of basement toilets and other drains. If this is impractical, make certain that they are provided with back water traps that are kept in working order. It may be prudent to provide a gate valve to back up the back water trap.

(7) Consider pole-mounted power transformers, or yard mountings on elevated platforms rather than transformer vaults below grade.

(8) Consider carrying the sheath of exchange and toll cables to the top of main distributing and protector frames as covered in BSP sections describing termination of such cables.

(9) Be certain that underground fuel oil tanks are properly anchored to concrete slabs cast in the bottom of the excavation, to counteract the buoyancy of partly empty tanks.

D. Consideration of Flood Hazards at Existing Buildings

5.06 Recent disasters point up the desirability of a review of existing buildings and their sites to determine (a) whether a potential flood hazard exists, and (b) if so, what measures could reasonably be undertaken to minimize the danger. Such a survey will serve to indicate the necessary corrective work at those building. In one area, for example, a review of 160 central office buildings revealed some 12 to 15 buildings that were proper subjects for varying degrees of corrective action.

5.07 When existing buildings are reviewed for flood hazards, consideration should be given to all of the design items mentioned in 5.05 with the exception of the first two—the presence of a basement and the height of the first floor level

which are established by the building as it exists. If there is a basement which could be flooded, the number of window and door openings in the basement wall should be eliminated or reduced to a minimum, and the situation regarding plumbing drains and air vents near grade through which flood waters might possibly enter should be investigated and corrected. Cable vaults are ordinarily vented above grade. If they are not and the vents are below possible flood levels, raising them should be considered. If it is impracticable to protect the basement against the entry of water, consideration should be given to relocating the equipment, such as power plants, engine alternator, and building house service panels, to new locations above grade. In some cases this has been deemed advisable, even at the cost of a whole or partial additional floor on the building.