Annex U

Hydropower Facilities Decommissioning Plan

Annex U: Hydropower Facilities Decommissioning Plan

U.1 General

This portion of the drawdown study details the actions required to decommission the four lower Snake River dams. Decommissioning is defined as preparing the hydropower facilities for suspension of power production, with a possible option of bringing the facilities back on line after an extended outage. The study team for decommissioning these hydropower facilities considered two major actions:

- Breaching the embankment dam and, by constructing levees, permanently channeling the river around the remaining dam structures, and leaving the dam structures in place.
- Breaching the embankment dam, temporarily channeling the river around the remaining dam structures, and removing the dam structures from the river.

The study team recommends the first action for reasons discussed in Section 9 of this appendix. That action requires the disposal of most of the hydropower facilities' equipment and on-site waste materials, but leaves the structures in place, yet off-limits, to public access. The options for disposal of all equipment, removal of any hazardous materials, and implementation of facility security are evaluated in this annex. The study team performed a detailed analysis for the Lower Granite Dam and applied that analysis, with appropriate modifications, to Ice Harbor, Little Goose, and Lower Monumental dams to determine the actions and costs for decommissioning all four dams.

U.2 Methodology

Under the first action, two options for disposing of facilities and equipment were identified:

- The Mothball Option involves suspending all operations and maintaining equipment in working condition until a decision is made to abandon or restore operations.
- The Abandon Option involves ceasing all activity, disposing of all equipment and materials, and abandoning the site.

Three ultimate conditions can result from the Mothball Option:

1. Mothball for 20 years then restore to full operating condition.
2. Mothball for 20 years then permanently abandon the structure.
3. Mothball for 20 years then permanently abandon the structure and demolish the structures (remove to below river bottom elevation).

Two ultimate conditions can result from the Abandon Option:

1. Abandon the structure.
2. Abandon the structure and later demolish the structures (remove to below the river bottom elevation).

U.3 Inventory of Systems

U.3.1 Physical Components

The Lower Granite Lock and Dam main structures include a six-unit powerhouse, an eight-bay spillway with stilling basin, navigation lock, fish facilities, concrete non-overflow sections, and an earthfilled embankment on the north shore.

The following systems must be considered when decommissioning the four lower Snake River dams:

1. Powerhouse systems
   a) Generators
   b) Circuit breakers
   c) Governors
   d) Dewatering pumps and sumps
   e) Transformers
   f) Lubricating systems
   g) Diesel and gasoline tanks
   h) Compressed air systems
   i) Emergency diesel generators
   j) Control room
   k) Main units (hydraulic turbines)
   l) Cranes
   m) Heating and ventilation systems
   n) Elevators
   o) Fish diversion screens
   p) Lighting systems
   q) CO_2 system
   r) Station batteries
   s) Oil storage in the powerhouse
   t) Storage (warehouse, paint, etc.)
   u) Domestic water wells and treatment
   v) Wastewater treatment plant

2. Navigation lock systems
   a) Upstream navigation lock gate
   b) Downstream navigation lock miter gate
   c) Navigation lock drain and fill valves
   d) Navigation lock low level dewatering systems
   e) Navigation lock floating guidewall

3. Spillway systems
   a) Spillway gates
   b) Gate operating machinery

4. Miscellaneous systems
   a) Fishway equipment
   b) Fish entrances
   c) Transportation and collection channel
   d) Attraction water supply
   e) Diffusers
   f) Counting station
   g) Fishway system control
   h) Fish collection system
   i) Visitor and viewing building
   j) Fingerling bypass
   k) Fishway watering and dewatering equipment
   l) Telephone system
   m) Radio base station
   n) Mobile cranes
   o) Power distribution system (4160 volts, 500 kilovolts, 480 volts, and 120 volts)
   p) Juvenile fish hold and load facility

5. Station Service Power requirements
   a) Energy from public utility
   b) Bonneville Power Administration (BPA) Switchyard/Power Co. Construction

U.4 Decommissioning Options

U.4.1 Mothball Option Required Actions

This decommissioning option would require that maintenance be continued on many of the hydropower facilities systems. Maintenance requirements, removal of equipment, or other preparation requirements were evaluated for the mothball option. Table U1 shows all of the significant maintenance or construction activities that would be required for the Lower Granite Dam if the mothball option were selected.

Table U1. Mothball Option Requirements page 1 of 3

Feature	Required Maintenance or Construction Activity
Generators and Turbines	1. Place the thrust-bearing pump on timer. 2. Leave the turbine runner full of oil. 3. Provide a method to keep turbine oil topped off. 4. To avoid damage to the thrust bearings, jack up the generator rotor to relieve pressure on the bearings due to the weight of the rotor. 5. Provide a power source to maintain the present control system to insure the proper ambient temperature. 6. Provide heating and ventilation systems. 7. Leave the heaters on in the generator housing. 8. Put in the head gates and the tailrace stop logs. Some head gates would need to be assembled.
Circuit Breakers	1. Maintain all governors on a regular maintenance schedule. 2. Exercise the wicket gates and blades each month.
Governors	1. Maintain all governors on a regular maintenance schedule. 2. Leave governor and oilhead full of oil. 3. Maintain governor pumps and air compressor. 4. Exercise the wicket gates and blades each month.
Dewatering Pumps	1. Maintain the dewatering pumps on their current maintenance schedule to avoid flooding the galleries. 2. Make sure bulkheads are in place during dewatering. 3. Maintain annunciation systems in operating condition.
Transformers	1. Maintain the nitrogen system on the regular maintenance schedule. 2. Provide backup power by connecting to the local public utility for station service power. 3. Check oil for moisture on a regular basis; check insulator status on a regular basis.
Lubricating Systems	1. Maintain the lubricating systems on a regular basis. Lubricating systems include hydraulic oil storage tanks, lubricating and transformer oil storage tanks, governor oil, pumps, piping, oil heaters, spillway gates, etc.
Diesel and Gasoline Tanks	Maintain the fuel pump on an annual basis.

Table U1 continued. Mothball Option Requirements page 2 of 3

Feature	Required Maintenance or Construction Activity
Compressed Air Systems	1. Replace the air system lubricants on a regular basis. 2. Prepare the navigation lock air system be fore long-term storage and maintain the 125-psi compressed air system in the powerhouse. 3. Exercise units on a monthly basis.
Emergency Diesel Generators	1. Keep the 500-kilowatt station emergency generator on line to provide power to the alarm system and the drainage pumps, in the event the back-feed power from the BPA line is lost. 2. Replace lubricants on a regular basis and exercise and test-operate each unit on a weekly basis.
Control Room	Keep the sequential event recorders operational for the annunciation system as well as for the phone line for external communications.
Main Units (Hydraulic Turbines)	1. Jack up and block the turbines to relieve pressure on the thrust bearings. Lubricate the bearings and the internal blade components and/or immerse them in oil to avoid corrosion. 2. Paint all surfaces that have a tendency to rust with an appropriate rust preventative paint. 3. Exercise the blades regularly to keep the internal parts freed up.
Cranes	1. Heat the gear boxes and protect the wire rope. 2. Maintain atmospheric conditions within the power house to avoid corrosion on the bridge crane. 3. Remove all wire rope from the cranes that are located outside. 4. Remove the diesel engine from the intake crane and store it within the powerhouse.
Heating and Ventilation Systems	Maintain heating and cooling requirements for the proper operation of the generator. Existing water source heat pumps would be inactive without a water source. A well could be drilled to supply water; however, it would be more economical to replace present heat pumps with electric heat pumps. The local public utility district would provide the power supply for the heat pumps by back-feeding power into the plant.
Elevators	Maintain the annual service contract with outside vendors.
Fish Diversion Screens	Remove and store the screens to reduce corrosion.
Lighting Systems	Replace lamp fixtures, as necessary, to provide a safe working environment.
Station Batteries	Record alarms using an alternating current system with an uninterruptable power system for back up. Remove the batteries.
Domestic Water	Maintain the water system on the current maintenance schedule.

Table U1 continued. Mothball Option Requirements page 3 of 3

Feature	Required Maintenance or Construction Activity
Wastewater Treatment Plant	Maintain all sewage lift pumps and associated equipment on the annual maintenance schedule.
Navigation Lock Systems Upstream Gate	1. Leave the gates on the latch pins to take tension off the lifting cables. 2. Maintain the oil- filled gear boxes in the lifting machinery of the upstream tainter gate. 3. Install both the upstream and downstream tainter valve bulkheads. 4. Bulkhead off the gates and drain the lock completely. 5. Block the gates, then close and lock the machinery rooms.
Downstream Miter Gate	1. Dewater the locks. 2. Install the floating bulkhead downstream to dry up the miter gate. 3. Use blocks to seal the floating bulkhead in case the tailwater goes up or down. 4. Leave the 914-millimeter (mm) (36-inch) valve open to the sump to keep the locks drained. 5. Leave the gate in the open position. 6. Provide cathodic protection of the bottom bearing, as necessary, since it will be under water. Change hydraulic oil on a regular basis.
Drain and Fill Valves	1. Change the oil on a regular basis and grease the bearings 2. Install a bulkhead in front of the fill valve in the lock. 3. Operate the drain valves occasionally.
Low Level Dewatering Systems	Lubricate all systems and provide cathodic protection, as necessary.
Floating Guidewall	Move the guidewall into the navigation lock before drawdown and store it in the navigation lock.
Spillway and Gates	Leave the gates closed if they are left in place.
Miscellaneous Systems	Drain air, water, oil, etc. from any of the following miscellaneous systems and leave them in place: fishway equipment, fish entrances, transportation and collection channel, attraction water supply, diffusers, counting station, fishway system control, fish collection system, visitor and viewing building, fingerling bypass, fishway watering and dewatering equipment, telephone system, radio base station, mobile cranes, power distribution system (4160 volts, 500 kilovolts, 480 volts, and 120 volts), and juvenile fish hold and load facility.

The study team also evaluated the different equipment and hydropower facility features at the other three dams compared to Lower Granite Dam to identify the major differences that would increase the effort (and resulting costs) for decommissioning at those sites. The major differences are as follows:

- Little Goose fish pumps are turbine driven whereas Lower Granite fish pumps are electrically driven. Turbine driven pumps would require additional labor to prepare them for extended outages. Corrosion of the unit would be a major concern.
- The Lower Monumental downstream and upstream navigation lock gates are lift gates, as is the downstream gate at Ice Harbor, whereas the navigation lock gates at Lower Granite are miter gates and tainter gates. Lift gates require the use of cables in their operation, and their storage would need to be considered if long-term outage is expected. In order to prepare the cables for storage, the load on the lifting cables would have to be lessened by the blocking of the counter weights. Once this is done, the cables could be removed for storage in the power house. This is necessary in order to prevent deterioration of the cables.
- Ice Harbor Lock and Dam has eight fish pumps on the south shore rated at 250 horsepower and three on the north shore rated at 200 horsepower. Lower Granite has two fish pumps at 800 horsepower each.

U.4.2 Abandon Option Required Actions

This decommissioning option would require that only minor maintenance activities be performed to maintain hydropower facility lighting. However, several non-maintenance items would need to be completed prior to and during drawdown. Table U2 shows the required activities if the Abandon Option is selected.

Table U2. Abandon Option Requirements

Feature	Required Activity
Equipment and Property	Excess all equipment and other government property.
Diesel and Gasoline Tanks	Remove the abandoned fuel tanks and disposed of in accordance with environmental requirements.
Lighting Systems	Replace lamp fixtures as necessary to provide a safe environment.
Navigation Lock Upstream Gate	1. Install both the upstream and downstream tainter valve bulkheads. 2. Bulkhead off the gates and drain the lock completely. 3. Block the gates, then close and lock the machinery rooms.
Navigation Lock Downstream Miter Gate	1. Dewater the locks. 2. Install the floating bulkhead downstream to dry up the miter gate. 3. Use blocks to seal the floating bulkhead when the tailwater goes up or down. 4. Leave the 914-mm (36-inch) valve open to the sump to keep the locks drained. 5. Leave the miter gates in the open position. (Close the lift gates.) 6. Provide cathodic protection of the bottom bearing, as necessary, since it would be under water. Change hydraulic oil on a regular basis.
Navigation Lock Floating Guidewall	Store the guidewall in the navigation lock.
Spillway and Gates	Leave the gates closed and remove the wire ropes.

U.4.3 Recommended Option for Implementation

The four lower Snake River hydropower facilities range in age from 23 to 48 years old. It is clear from the maintenance records that the older projects are exhibiting problems associated with aging equipment. Much of the equipment is at the extreme end of its useful life and would likely require replacement during a project restart. It would not be economical to maintain the equipment for 20 years and then have to replace it if the hydropower project is restarted.

Furthermore, the cost of removing and relocating equipment, considering its age, is excessive. Much of the equipment is customized for its current location and would require modification for use by other Federal hydropower facilities. The conclusion of this study is that, as a whole, there is no economic salvage value for the equipment at each of the plants. Consequently, this implementation plan is based on abandoning the hydropower facilities.

The Abandon Option requirements associated with decommissioning would be performed during and after drawdown. The only item that needs to be completed before drawdown is the construction associated with providing power from the public utility. Power for lighting and security would be needed when power production is stopped at the dams.

U.5 Hazardous Materials, Substances, Chemicals, and Wastes

U.5.1 General

Each dam site has numerous items that can be classified as hazardous/dangerous materials, substances, chemicals, or wastes under Federal and state laws. In the event the hydropower facilities are decommissioned, all items that are designated as solid wastes would need to be identified, characterized, and disposed of in accordance with Federal, state, and local regulations and codes.

U.5.2 Inventory of Hazardous Materials, Substances, Chemicals, and Wastes

The following is a list of hazardous materials, substances, chemicals, and wastes normally found at a hydropower facility that may require disposal actions if not recycled or reused for their intended purpose:

1. Polychlorinated Biphenyls (PCBs)
2. Asbestos
3. Paint/abrasive blast grit (red lead paint)
4. Oil
5. Mercury
6. Antifreeze
7. Halogenated and non-halogenated solvents
8. Greases
9. Pesticides (includes herbicides, insecticides, and wood preservatives)
10. Petroleum contaminated
11. Chlorinated fluorocarbons (CFCs) Freon/Halon

12. Gasoline/diesel (includes product and sludge in tanks)
13. Batteries (includes acid)
14. Water treatment sludge (septic tanks/wastewater treatment)

U.5.3 Regulatory Overview and Assumption

Many of the materials and items listed above would meet the definition of a solid waste given in 40 Code of Federal Regulation (CFR) 261.2 and the Washington Administrative Code (WAC) 173-303. This would determine the item's ultimate disposal either as a solid waste or a dangerous/hazardous waste, depending on its condition at the time of decommissioning (e.g., whether it was used material or contaminated material). This study team based its recommendations and costs on the assumption that the potential wastes listed above would require disposal in a Federal- or state-permitted municipal landfill or treatment, storage, and disposal facility (TSD). It should be noted that many of the materials and items listed above (if unadulterated with other regulated hazardous contaminants) could be recycled or used at other Corps hydropower facilities, thereby eliminating the need to dispose of these materials.

U.5.4 Discussion/Recommendations

1. PCBs

   PCBs are still present in small amounts at most facilities, primarily in light ballasts and capacitors. PCB-contaminated articles (e.g., transformers, drums, light ballasts) would have to be properly disposed of if decommissioning occurs. Disposal requirements given in 40 CFR 761 would determine ultimate disposal costs.

2. Asbestos

   Most asbestos has been removed from the dam facilities. There are still some locations, such as breaker panels, where removing the asbestos is not feasible or necessary unless it becomes fixable or damaged and presents an exposure hazard to employees. Asbestos disposal requirements given in 40 CFR 61 would determine ultimate disposal costs.

3. Paint

   Most external structures at the dams are coated with high concentrations of lead-based paint. If lead-based paint is removed from structures during decommissioning, the resulting paint waste must be tested to determine if it is a toxicity characteristic hazardous waste. Paint waste that exceed the regulatory level for lead or other contaminates (40 CFR 261.24) must be disposed of in a Federal-/state-permitted TSD. Old, unused, and contaminated (mixed with solvents) paint in containers would also have to be disposed of as a solid or hazardous wastes, depending on laboratory analysis results.

4. Waste or used oil

   Each hydropower facility has at least 570,000 liters to 950,000 liters (150,000 gallons to 250,000 gallons) of oil currently in use. This oil would have to be properly disposed of in the event of decommissioning. Oil removed from the turbines and other equipment, including transformer oil, would be either a waste oil (40 CFR 761) or used oil (CFR 279, WAC 173-303-515), depending on prior use and contaminants found in the oil. Containerized oil containing contaminants such as solvents are commonly encountered at hydropower facilities. Oil sludges are common in

tanks. Oil disposal would likely be costly due to the large volumes found at hydropower facilities and the ease of contamination with other regulated hazardous wastes.

5. Mercury

   Fluorescent light bulbs and switches are the primary sources of mercury waste at these facilities. Thermostats or temperature regulating switches could be disposed of under the Universal Waste Rule (40 CFR 273). Other metallic mercury wastes found at hydropower facilities should be in minimal amounts; however, the disposal of metallic mercury waste not covered by the Universal Waste Rule might require disposal by incineration, which is costly even for small quantities.

6. Antifreeze

   Antifreeze must be recycled or disposed of as a regulated dangerous/hazardous waste (WAC 173-303). Most, if not all, used antifreeze generated at hydropower facilities can be reused or recycled. Most municipal landfills accept used, uncontaminated antifreeze. Since commercial vendors who perform routine maintenance on hydropower facility fleet vehicles dispose of the antifreeze from these motor vehicles off-site, only small quantities of anti-freeze waste from cranes, vans, and sedans serviced on-site would need to be recycled or disposed of as a dangerous waste.

7. Solvents

   Solvents are used extensively for degreasing operations at hydropower facilities and are probably the second largest source of potential regulated hazardous wastes found there. Solvents are used as thinners for painting applications, and aerosol containers of degreasers and solvents are prevalent in maintenance shops. Spent solvents mixed with used oil is a common source of regulated waste at hydropower facilities.

8. Greases

   Greases use on the turbine units and other equipment would have to be disposed of, especially in locations where there is direct contact with the water. In most cases, greases can be burned for energy recovery (WAC 173-303-510). Greases in their original containers can be reused or recycled. If not contaminated with a regulated chemical or material, greases in open containers can also be reused or recycled.

9. Pesticides

   Hydropower facilities use pesticides, (herbicides and insecticides) on the levees or in and around the facilities for insect and weed control. Unless contaminated with other regulated wastes, pesticides can be reused at other hydropower facilities in accordance with registered label directions. Rinsed pesticide containers can be recycled or disposed of as a solid waste. Unused/waste pesticides can be disposed of at the Washington State Department of Agriculture designated hazardous material collection sites. Disposal of pesticides designated as dangerous waste is regulated by the Washington State Department of Ecology (Ecology). Pesticide wastes requiring disposal should be minimal at hydropower facilities if they have been managed correctly.

10. Petroleum-Contaminated Soil

    Petroleum-contaminated soils are typically cleaned up as the spills happen, but there could potentially be some areas where the soil has been contaminated early in the history of the facility.

Petroleum contaminated soil form past activities may be encountered when soil is removed during the decommissioning of the dams. These areas would have to be studied and analyzed to ensure that no petroleum contaminated soil above Ecology cleanup standards remain. Soil permitted landfill facility, treated on site, or land farmed which reduces disposal costs.

11. CFCs and Halons

    Freon and Halon are used as refrigerants/coolants (heat pumps), and in fire extinguishing systems respectively at hydropower facilities. These ozone-depleting compounds would have to be properly recycled or reclaimed to comply with Clean Air Act's or quality standards. Additionally, CFCs are also found in used oil after reclamation and therefore may be subject to the used oil disposal requirements mentioned above. Special requirements of CFCs are given in WAC 173-303-506.

12. Gasoline and Diesel

    Gasoline and diesel storage tanks are located a each facility. These tank must be emptied of product in the event of decommissioning. Unused product can be used for fuel. Gasoline and diesel contaminated with water can be burned for energy recovery. Sludge disposal costs must be considered when gasoline and diesel tanks are emptied. Sludges remaining in both the diesel and gasoline tanks may contain regulated waste compounds (benzene) or metals (lead) and may be disposed of as dangerous wastes.

13. Batteries

    Batteries, including spent lead-acid batteries, and battery acid (electrolyte), used in power houses and other facilities must be disposed of if decommissioning occurs. Battery disposal requirements are given in 40 CFR 273, and WAC 173-303. Spent batteries and electrolytes must be reclaimed or disposed of as a regulated hazardous/dangerous wastes.

14. Wastewater Treatment Sludge

    Powerhouse wastewater treatment and septic tank sludge must be removed and disposed of if decommissioning occurs. Federal requirements for treatment and disposal of sewage sludge are given in 40 CFR 403 and 503. Sewage sludge (biosolids) may contain toxic pollutants (metals) which impact disposal options. Sewage sludge are generally excluded from Federal and state hazardous/dangerous waste disposal requirements (40 CFR 261.4 and WAC 173-303.071). Sludge must be tested for toxic pollutants prior to disposal.

U.5.5 Disposal Sites

Specific disposal sites for the listed hazardous materials were not specifically identified. Several commercial sites are currently in operation in the Pacific Northwest. Those facilities are able to handle the quantity of listed materials that would eventually be transported to such a site. Note that many of the listed materials are products that are useful to power facilities on the Columbia River. Disposal requirements make those materials available for use by others before disposal is considered.

U.6 Hydropower Facilities Security

U.6.1 General

Currently, the public has access to most of the exterior of the hydropower facilities, including the tailrace, forebay, fish facility, navigational lock, and the top deck of the dam. All four projects provide a public roadway across the river generally available for public use during daylight hours. All entrances to the interior of the hydropower facilities have secured access requiring authorization and a key. There is little restriction on public water access to the navigation lock for upriver or downriver lockages, however, access to the hydropower facilities, the approach channels, and the discharge and spillway channels are restricted.

There are three possible options for security at the abandoned hydropower facilities after drawdown:

- **Option A. Use and expand the current security system.**

  The current security system consists of closed circuit video monitoring and keyed locks on all access doors to the interior of the hydropower facilities. This system could be upgraded and tied into the current radio system for alarm purposes to the local authorities.

- **Option B. Contract out to a private concern.**

  Contracting with a 24-hour-monitoring service and upgrading any controllers necessary would allow for the addition of fire and environmental monitoring. This type of monitoring also could be done remotely.

- **Option C. Install security fences and signs.**

  Access to the hydropower facilities by vehicular traffic would be denied by blocking all roads with chain link fences at each entrance to the facility. Government property signs would be installed indicating no trespassing on government property. Fencing would also have to be installed on the perimeter of the structure to deny access to anyone entering either by foot or by boat, either up or downstream. All access doors to the structure would be locked and all windows screened. This option would also include periodic, manned surveillance of the hydropower facilities.

U.6.2 Recommended Option

In the event that drawdown does occur and the hydropower facilities are completely shut down, the study team recommends that fencing and signs be installed and manned periodic surveillance be performed as stated above in Option C.