

BLUEFISH DAM REPLACEMENT PROJECT UPDATE – OCTOBER 2009

BACKGROUND

Bluefish Hydro was originally developed by Nerco Con Mines. Construction began in 1940 and first power was generated in 1942. As part of that development an impoundment dam was constructed at the outlet of Bluefish Lake. The original construction of the dam was rock filled timber crib. The normal life expectancy of a timber crib dam is approximately 40 years however upgrades to the dam completed in 1973, 1983 and 2007 extended the dam's life beyond the normal expected period.

In 2002, NTPC completed the purchase that began in 2000, of Bluefish Hydro from Miramar Con Mine for just under \$12 million.

The facility consists of two dams, a head gate, penstock, and two power plants that house hydro electric generators.

Under average water conditions Bluefish Hydro has the potential to provide up to 20% of Yellowknife's annual electricity needs that would otherwise be met with 11 million litres of diesel generation.

The Jackfish diesel plant is now predominantly a standby plant providing back-up when hydro is unavailable.

NTPC PURCHASE

Bluefish Hydro has returned many times its acquisition cost in avoided diesel fuel and diesel capital costs for NTPC customers.

A condition assessment conducted by AMEC in 2001 noted that Bluefish Dam would need to be replaced sometime in the next 10-20 years. Very little value was assigned to the dam at the time of purchase.

However, the remainder of the assets were considered a great value for NTPC customers. For example, a second power plant was constructed by the previous owner in 1995 at an estimated cost of \$17.5 million. The unamortized value of that plant alone exceeds the \$12 million that NTPC paid for the entire facility.

When Bluefish was purchased in 2002, the Public Utilities Board completed a thorough review of all aspects of the purchase – condition assessment, net present value, cost-savings for customers – and determined that Bluefish was a prudent expenditure. The fact that NTPC has been able to provide low-cost hydro power, as opposed to diesel power, adds further value to this asset, not to mention the environmental benefits through reduced greenhouse gases.



A second spillway was constructed in the summer of 2008 to relieve hydrostatic pressure behind the dam.

RECENT CIRCUMSTANCES

NTPC implemented the recommendations of the 2005 Dam Safety Review and anticipated that this would provide enough time for an orderly replacement of the dam. However, in 2008, NTPC operators at Bluefish reported higher than normal flows in the Yellowknife River adjacent to the generating area. These flows were investigated and it was determined that a leak had developed near the left abutment of the dam.

In June, 2008 NTPC staff and EBA Engineering Consultants Ltd. completed a condition assessment of the Bluefish Dam. The investigation yielded the following observations:

- The leak was confirmed by a sinkhole in the upstream mat and the deposit of the material at the toe of the downstream rock fill.
- A section of the timber sheeting on the overflow spillway had fallen away and exposed the timber crib beneath. The timber crib had deteriorated to the point of collapse.

The state of the dam and spillway represented a risk to the environment if the dam failed and an emergency action plan was implemented. This plan was comprised of two components as follows:

- Emergency operating procedures.
- Emergency repairs.

The Mackenzie Valley Land and Water Board was notified of NTPC's intentions to proceed with emergency repairs under Section (17) of the Mackenzie Valley Land Use Regulations in June 2008.

The Emergency Plan was implemented and the repairs were completed in August 2008. These repairs did not represent a permanent fix of Bluefish Dam, but only served to reduce immediate risk associated with the collapsing overflow spillway.

EMERGENCY PROCEDURES AND REPAIRS

Since August 2008, NTPC has:

1. Implemented emergency operating procedures including:
 - Mobilized equipment and materials to be able to respond to a breach (heavy equipment, pumps, silt curtains, watercraft).
 - Installed a visual monitoring system on the dam.
 - Worked with the regulatory agencies to put public protection measures in place (restrict activities immediately downstream of the power houses in the Yellowknife River).
 - Implemented special operating procedures/surveillance and monitoring that include twice daily inspections.
 - Ongoing water management to reduce peak flows in the Yellowknife River over Bluefish Dam.
 - Notified regulators of the emergency.
2. Constructed an emergency spillway. The goal of this spillway was to lower the reservoir to decrease the hydrostatic pressure on the dam as well as provide for reliable spilling of water during normal flow conditions. Since installation annual flows have been well above normal.
3. NTPC has upgraded its auxiliary spillway at Bluefish Dam to permit safer and faster operation.



Emergency spillway under high flow conditions in the fall of 2008

CURRENT CONDITIONS

The dam's deterioration has accelerated at a rate that could not be predicted in 2001, or even last year for that matter due to the unexpected failure of the impermeable barrier that prevents leakage. External consultants were retained to provide repair and replacement options and after analyzing the situation it was concluded that there is no form of repair that can stop the dam from eventually failing. The only remaining option is to replace it.

1. The leakage through Bluefish Dam is increasing. In January 2008 the leakage was estimated at 3.5 m³/s. In August 2009 it was estimated at 12 to 15m³/s. That represents an increase of 340-400% in 20 months. We expect this increase in leakage to continue.
2. The timber overflow spillway and crib are in accelerated decay. This is probably due to the cyclic wet/dry periods now introduced to the structure due to the construction of the emergency spillway. The upstream timber sheeting, which has remained intact to date, is beginning to collapse. This deterioration will continue.
3. Due to a concentration of flow through the Emergency Spillway there is erosion taking place in the downstream rock fill buttress. The integrity of the downstream buttress is crucial to the overall integrity of Bluefish Dam in its current deteriorated state.

NTPC'S RESPONSE

In addition to emergency measures identified earlier, NTPC immediately began planning a replacement dam. The corporation has undertaken environmental, consultation, geotechnical, construction and engineering studies to move the construction timetable forward as fast as allowed under current legislation.

On October 13, 2009, the Mackenzie Valley Land and Water Board granted NTPC an emergency exemption from preliminary screening for Land and Water Use Permits.

In its decision the Board stated: ***"After reviewing all the information on the record and in particular the new evidence, the Board was persuaded that there are limited options available to NTPC to respond to the unexpected and accelerated deterioration of the dam over the last year."***

The decision does not exempt NTPC from complying with the environmental oversight or directives issued by the Board. The Board will continue processing NTPC applications as set out in the project work plan.

The emergency exemption assures the corporation that it can move equipment and materials to site over the ice road and begin construction in the spring. The compromised state of the existing structure requires an aggressive timeline. NTPC plans to commission the dam in 2011.

This represents the shortest practical timeline possible for the project, given the remote nature of the site.

On October 19, 2009 Transport Canada informed NTPC that the proposed dam requires approval under the Navigable Waters Protection Act. NTPC is currently reviewing this new requirement and discussing its implications with Transport Canada.

THE ENVIRONMENT

NTPC has established minimal impact on the environment as one of its major goals with respect to ongoing operations and new projects. The corporation has done, and will continue to do, environmental and archaeological studies for the water licensing process. This will provide the information to ensure the integrity of the environment is maintained.

The water licensing process will examine the impact of the new dam and steps taken to mitigate its impact. Preliminary indications suggest that a new dam, with better flow control, will have a positive effect on the integrity of downstream fish habitat.

CONSULTATION

Throughout 2008 NTPC undertook consultation with respect to the construction of the Bluefish Dam replacement, following the Public Involvement Guidelines for Permit and Licence Applicants to the Mackenzie Valley Land and Water Board. A consultation report and all other submissions are posted on the Board's web site.

PRE-CONSTRUCTION

With the emergency exemption in place, NTPC can shift its attention to pre-construction initiatives and obtaining a water license and land use permits.

Through the fall, the corporation will issue contractor pre-qualification terms, short list qualified respondents and then invite tenders. Design and project management plans have been completed and the corporation has applied to the Public Utilities Board for a major project permit and approval to borrow up to \$18.5 million for the project.

Over the winter NTPC will build an ice road and haul equipment and materials to site, including a 50-person camp.

Northern and local Aboriginal businesses will have opportunities to qualify and/or bid on all aspects of the project.

THE PROJECT

The replacement dam will be located 427 metres downstream of the existing dam. At this location, a natural bedrock ridge crosses the Yellowknife River. A dam in this location would increase the size of the impoundment area (Bluefish Lake) by 8.07 hectares.

Several configurations were examined for the replacement dam's impermeable rock fill core. The flow control spillway will be located on the west side of the dam and will be designed to accommodate the probable maximum flood conditions.

Dam Physical Properties

Dam Crest Elevation	171.06m
Elevation at Bottom of Dam	162.00m
Maximum Reservoir Level	170.06m
Length	250m
Height	9.06m
Area of Inundation	8.07 Hectares

Spillway Physical Properties

Length	150m
Elevation at Bottom of Spillway	162.00.m
Elevation at Top of Spillway	171.06m
Width	30m
Height	9.06m

COST AND RATE IMPACT

NTPC has applied to the Public Utilities Board for a major project permit and approval to borrow up to \$18.5 million. The application includes analysis that illustrates a new dam is by far the least cost option.

The Bluefish Dam replacement will add approximately 1 cent per kWh to customers' rates who are served by the project. Currently there are 1.8 cents per kWh in riders that will end before the cost of Bluefish is added to rates.

On the other hand, the rate impact rises dramatically if the old dam fails and the corporation is forced to replace hydro with diesel generation. The cost of diesel fuel alone would be \$7 million per year. The corporation would also need to purchase and install 7MW of new diesel at Jackfish so that it could provide power in the event of a problem with the Snare transmission. The additional capital cost would be in the range of \$7-\$10 million.

The application, information requests and arguments filed with the Public Utilities Board are posted on the corporation's web site: www.ntpc.com

Bluefish Dam Questions and Answers

Did NTPC know the condition of the dam when it bought Bluefish?

Yes. The need to replace the dam was fully disclosed in regulatory filings at the time of purchase.

A condition assessment conducted by AMEC in 2001 noted that Bluefish Dam had exceeded the normal service life of most timber crib dams and would require future maintenance and upgrading.

In negotiating the purchase price, NTPC assigned very little value to the existing dam structure, since it had already exceeded the normal useful life of such a facility. The primary value of the dam was related to the rights to a facility at that location and the associated storage.

If the dam was deteriorating why did you let this become an emergency?

We knew the dam was deteriorating and would eventually need replacing. Reviews done by AMEC, our insurers and a Dam Safety Review all indicated that there was time for an orderly replacement. Work was done to extend the life of the dam as recommended by the Dam Safety Review. Compliance with the Dam Safety Review is a condition of the water licence.

Before the orderly replacement of the dam could begin a hole developed in the impermeable barrier that prevents the dam from leaking at an unacceptable rate. This damage increased the leakage to the point that the dam will eventually fail.

The corporation has a very low tolerance for risks to the environment and people and has established minimal impact on the environment as one of its major goals with respect to ongoing operations and new projects. This means addressing the issue is an emergency and NTPC has proceeded with both repairs and the design of a replacement dam as quickly as possible.

What is the nature of the emergency?

Simply stated, we know the dam is going fail at some point and we have a legal obligation to ensure all of our facilities are operating in a safe manner. The deterioration of the dam has accelerated at a rate that couldn't be predicted in 2001 or even last year.

When it fails, replacement power will be generated through diesel plants, which puts air quality and the environment at risk.

If it fails because we didn't take all reasonable steps to construct a replacement dam the corporation would be exposed to charges and penalties by environmental regulators.

Lastly there's the impact on customer rates if we're serving Yellowknife with diesel generation or our customers are exposed to the cost of penalties and fines.

Individually these are serious risks. Collectively, they constitute an emergency. We need to replace Bluefish dam as quickly as possible.

Will there be any environmental oversight?

The decision doesn't exempt NTPC from complying with the environmental oversight or directives issued by the Mackenzie Valley Land and Water Board.

In its decision the Board stated: *"After reviewing all the information on the record and in particular the new evidence, the Board was persuaded that there are limited options available to NTPC to respond to the unexpected and accelerated deterioration of the dam over the last year."*

The Board will proceed with its regulatory responsibilities and will continue processing NTPC applications as set out in the project work plan.

We've been cooperating with the regulatory process and will continue to do so. But we needed assurance that construction could begin in the spring or we would lose another year.

The emergency exemption assures the corporation that it can move equipment and material to site over the ice road and begin construction in the spring. NTPC plans to commission the dam in 2011.

How much did NTPC pay for Bluefish?

The facility was purchased for \$11.86 million in 2002. Because of the condition of the dam very little value was assigned to it at the time of purchase.

The Public Utilities Board completed a thorough review of all aspects of the purchase – condition assessment, net present value, cost-savings for customers – and determined that Bluefish was a prudent expenditure.

The corporation's customers have received many times the value of the acquisition cost in avoided diesel fuel and diesel capital costs.

As importantly, a second turbine was installed by the previous owner in 1995 at a cost of approximately \$17.5 million. The unamortized value of that power plant exceeded the purchase price of the entire facility.

Since the purchase, NTPC has been able to provide low-cost hydro power as opposed to diesel power, not to mention the environmental benefits through reduced greenhouse gases.

What impact will a new dam have on the environment?

We estimate that dam construction will have very little environmental impact and we're committed to meeting all environmental requirements. The new dam will have a positive effect on the integrity of downstream fish habitat by maintaining base minimum flows.

What work has been done on the dam to prevent this emergency situation?

Since the Bluefish acquisition, major capital projects performed on the dam include:

- 2005/06 Dam Safety Review
- 2006/07 – Buttress Bluefish Dam (\$0.917 million)
- 2008/09 – Bluefish Emergency Spillway (\$0.296 million)

These additional costs were undertaken to reduce hydraulic pressure on the dam and these steps worked.

When will the dam fail?

The final failure of Bluefish dam will depend largely on environmental conditions. A freshet with flows consistent with 1991 would probably result in a dam failure. Average or lower annual flows may permit safe operation for the next 3 to 5 years. If the past two years are any indication, the trend is toward higher than average levels in the Yellowknife River.

This reasonable expectation of failure has been acknowledged in correspondence received from the Mackenzie Valley Land and Water Board.

How much will the new dam cost?

We have applied to the Public Utilities Board for a major project permit and approval to borrow up to \$18.5 million.

Our application includes analysis that illustrates a new dam is by far the least cost option.

What impact will the project have on customer rates?

The impact on rates is approximately 1 cent per kWh. Currently there are 1.8 cents per kWh in riders in effect that will end before the cost of Bluefish is added to rates.

The rate impact rises dramatically if the old dam fails and we're forced to replace hydro with diesel generation. The cost of diesel fuel alone would be \$7 million per year.

The corporation would also need to purchase and install 7MW of new diesel at Jackfish so that it could meet customer requirements in the event of a problem with the Snare transmission.