Together Against Sizewell C

Deadline 10 Submission TASC IP no. 20026424

TASC comments on ExQ3 Part 2 responses submitted at deadline 8

Bio.3.8 Question to the Applicant

Applicant's response is set out in REP8-116:

The Applicant explains that the intake screen and pipework would require periodic shock chlorination, which would be flow controlled and angled inwards to prevent chlorine emissions to the environment. *Why does the outfall pipe not also need chlorination or treatment?* SZC Co. Response at Deadline 8, Chlorination is a treatment used to control biofouling. Biofouling is the growth of marine organisms on or inside the water systems. At the desalination intake marine water, inclusive of entrained larvae or marine organisms, will be drawn in through the intake. While the intake structure itself will be protected against clogging of the Passive WedgeWire Cylinder screen by means of a compressed air cleaning system, entrained marine organisms that enter the intake tunnel have the potential to settle in the interior of the tunnel potentially leading to biofouling. Chlorination at the intake head prevents settlement and grown within the intake tunnel. The discharge is composed of the water which has already been treated and been through the Sea Water Reverse Osmosis (SWRO) membranes. No viable marine organisms would be present after this process and therefore the discharged water does not pose a biofouling risk. At the outfall diffusers the water velocity will be sufficiently great to prevent ingress of marine organisms into the discharge pipework. Therefore, chlorination of the outfall diffusers and outfall pipe is not required.

TASC comment:-

TASC responds by quoting from the report submitted by Marine Ecologist Dr. Peter Henderson, in respect of ISH 15, held on the 5th October:

Wedge-wire screens have a proven ability to reduce both impingement and entrainment mortality at low volume intakes (to 2.5 m^3s^{-1}). Their effectiveness is related to (1) the slot width, (2) through-slot velocity, (3) existence and strength of ambient cross flow to carry organisms away from the screen, (4) the amount of biofouling and (5) the amount of ambient debris. As is set out below, the effectiveness of wedge-wire screens is linked to water velocity across the screen.

Wedge-wire screens with slot widths of 5 to 10 mm have been used to effectively eliminate impingement at freshwater cooling water intakes. They have rarely been used at marine or estuarine facilities, probably because of fears that biofouling and screen blockage would lead to operational problems. Small-scale trials of Johnson wedge-wire screens at Fawley in the 1980s showed that standard steel wedge-wire screens developed a fouling community (Bamber and

Turnpenny, 1986). Even a Johnson 715 alloy (70% Cu: 30% Ni) screen that leached copper and thus poisoned organisms that had settled experienced some fouling.

It is clear that the reductions in impingement and entrainment possible using wedge-wire screens will be determined primarily by the slot width, the water velocity across the screen and the mix of species present at the particular locality. In marine locations the problem is that 2 mm slot widths which, will greatly reduce entrainment losses of early fish life-stages when clean, are highly vulnerable to fouling. Trials in the USA show that for good protection, across screen velocities of 0.25 feet per second (fps) which is about 0.3 ms^{-1} are required. These are quickly exceeded when fouling occurs. This risk is clearly noted in the Design Criteria for Fish Screens in Virginia Gowan & Garman (1999) where on page 32 it states: "*Screens partially clogged with debris have hot spots where through-screen velocity exceeds approach velocity criteria.*"

Reduction of the filtering area could occur if (1) there were high levels of debris in the water, e.g. seaweed, blocking the screens that were not efficiently removed by airburst cleaning, or if (2) biofouling occurred. Biofouling is the process by which a community of organisms gradually grow on the surface of the screen leading to the blocking of the mesh. Either possibility would lead to an increased in through-screen velocities. This is because as the biofouling blocks the slots the water must pass across a reduced cross-sectional area. If the volume of water pumped is to remain constant the velocity must inevitably increase. I consider the possibility for increased through-screen velocity as a result of biofouling to be a

very significant concern.

Biofouling is a constant threat to the functioning of screens and must always be considered. To quote from the EPRI (1999) report on Fish Protection at Cooling Water Intakes TR-114013:

"*From an engineering viewpoint, a primary concern with coarse or fine-mesh cylindrical wedge-wire screens at many projects is the ability to prevent or control biofouling. Biofouling of interior surfaces by organisms such as mussels, barnacles, bryozoans and zebra mussels is particularly problematic since these surfaces are not easily accessible for manual cleaning by divers.*"

All waters hold potential fouling organisms. For many filter feeding species, filter screens, with their steady gentle flow, are an ideal habitat. Occasional airbursts to clean the screens is unlikely to be effective against biofouling, however, because these organisms, unlike dead material such as leaves, are adapted to attach very firmly to the material. Further, the young stages can settle and grow inside the intake screens and air-burst is designed to remove material from the outer surface of the screen. It has also been found that airburst will not clean all the surfaces of a wedge wire screen. For example, the Evaluation of Delta Wetlands Proposed Fish Screens, Siphons and Pumping Stations report, produced for Dept. Water Resources, California, December 2001 states that:

> "*The periodic burst of air can lift debris if there is a strong sweeping flow to carry away debris, but it does not replace periodic manual brush cleanings by divers. The advantage of this type of screen is that the screens are quite durable, if protected from heavy river debris, and do not have moving parts. The disadvantage is that the air cleaning is only marginally effective at cleaning the debris from the underside of the screens.*

Biofouling can be reduced if the screens are constructed from copper-containing alloys rather than stainless steel. In the Great Lakes, for example, where zebra mussels are a problem, a cupro-nickel alloy has been used. There is nothing in documentation to suggest whether the screens would be made of an alloy effective for repelling organisms. Moreover, in the event that a copper-nickel alloy were used, this would inevitably result in the leaching of small amounts of copper into the environment. The possible impacts of heavy metal leaching from such screens would be another impact to consider.

For wedgewire screens to be effective, there must be a sweep velocity greater than the through-screen velocity along the surface in order to carry debris and animals past the screen. The need for a sufficiently high sweep velocity is made clear in the EPRI (1999) report on Fish Protection at Cooling Water Intakes TR-114013:

"*Another factor that may limit application of wedge-wire screens in some environments is the lack of ambient currents to sweep organisms past the screen and carry backwashed debris away. This is an important requirement of this technology. Therefore, it may not be practicable to consider in water bodies without at least a low velocity cross-current.*"

TASC have not read of a tidal velocity analysis undertaken by the Applicant to allow the view that the sweep velocity will be sufficiently high to allow the wedge wire screens to function as required.
