HUSZPO HRVATSKA UDRUGA STRUČNJAKA ZAŠTITE PRIRODE I OKOLIŠA

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Ivančica Somođi / Marija Čulina Rapo / Metod Šolto

# River Debris Treatment Methods on Hydropower Plant – Cleaning the River from Debrise

## Zbrinjavanje naplavina na hidroelektranama – čišćenje rijeka

**Ivančica Somođi**, *dipl. ing., HEP-Proizvodnja d.o.o. PP HE Sjever Varaždin, Međimurska 26c, Varaždin, Croatia (ivancica.somodi@hep.hr)*
**Marija Čulina Rapo**, *struc. spec. ing. sec., HEP-Proizvodnja d.o.o., PP HE Jug Split, Ivana Gundulića 42, Croatia (marija.culinarapo@hep.hr)*
**Metod Šolto**, *dipl. ing., HEP-Proizvodnja d.o.o., PP HE Jug Split, Ivana Gundulića 42, Croatia, (metod.solto@hep.hr)*

# Use of hydro power potential in Croatia

- 1895. ⇒ the first HPP Jaruga
- 2017. ⇒ 26 hydropower plants
- accumulation and flow type HPP
- at 13 major watercourse

(Drava, Kupa, Rječina, Lika,Gacka, Trebišnjica, Ličanka, Lokvarka, Krka, Cetina …)

- **some hydropower plants parcipation in waste management service in local community**
- management of solid waste therefore presents an increasingly acute problem

**FIGURE 1.** Hydro power plants in Croatia.

## HYDROELECTRIC POWER PLANTS IN GENERATION AREA "NORTH" - HPP VARAŽDIN

- HPPs built on the Drava River in Croatia
- (low-head, diversion-type HPPs with reservoirs for daily and partial weekly regulation of inflow)

The HPP Varaždin-North is 19th of the 21 HE Power-Plants on 720 km long Drava river (10 in Austria, 8 in Slovenia, 3 in Croatia).

HPPs are **downstream** of Ferlach, Villach, Dravograd, Ormož, Varaždin …

- installed flow: Qi = 500m$^3$/s

**FIGURE 2.** Drava river basin.

## HYDROELECTRIC POWER PLANT IN GENERATION AREA "SOUTH" - HPP ĐALE

- HPPs built on the Cetina River in Croatia
- located in the **canyon of the river Cetina**, **downstream** of Trilj
- uses energy potential to drop 21m between the Sinj field and the Prančevići reservoir
- adjacent-to-dam, storage
- installed flow: Qi = 220m$^3$/s (2x110)

**FIGURE 3.** Part of cetina river basin.

## DEBRIS ON WATERCOURSES, WHAT IS THAT?

- represented of all flooding materials organic (woody debrise) and an organic origin floated by river, which floated on hydropower plant
- woody debrise mixed with any human-made solid material that is abundant on river beaches or woods: municipal solid waste, electric, electronic waste, car tires, plastic packaging, polystyrene, metal, and other manufactured materials
- approximately **300-400 t/year** were collected and disposed off by workers on HPP North
- management of solid waste therefore presents an increasingly acute problem
- hydropower plant safety is endangered
- high costs
- serious hazard to the environment

**FIGURE 4.** Debrise on HPP Čakovec 6.11.2012.

- the Law on Sustainable Waste Management – did not recognize it, but it recognize

"**marine waste**„ - waste in the marine environment and coastal area in direct contact with the sea that is generated by human activities on land or sea and is located on the surface of the sea, in the water column, at the seabed or is flooded

# DEBRISE MANAGEMENT ON HPP VARAŽDIN

- get out of the water
- waste disposal in temporary repository drying
- selection
- transport to the municipal waste management company
- ⇑ significant costs of waste management and disposal

**FIGURE 5,6.** The flooding waste on HPP Varaždin

**FIGURE 7.** The repository on HPP Varaždin

# DEBRISE MANAGEMENT ON HPP VARAŽDIN

| Types of debrise on HPP Varaždin t/year | | | | |
|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2016 |
| plastic | **1,62** | 0,4 | 0 | 0,5 |
| glomazni | 0,08 | 0,04 | 0,08 | 0,5 |
| EE | 0,03 | 0,052 | 0 | 0 |

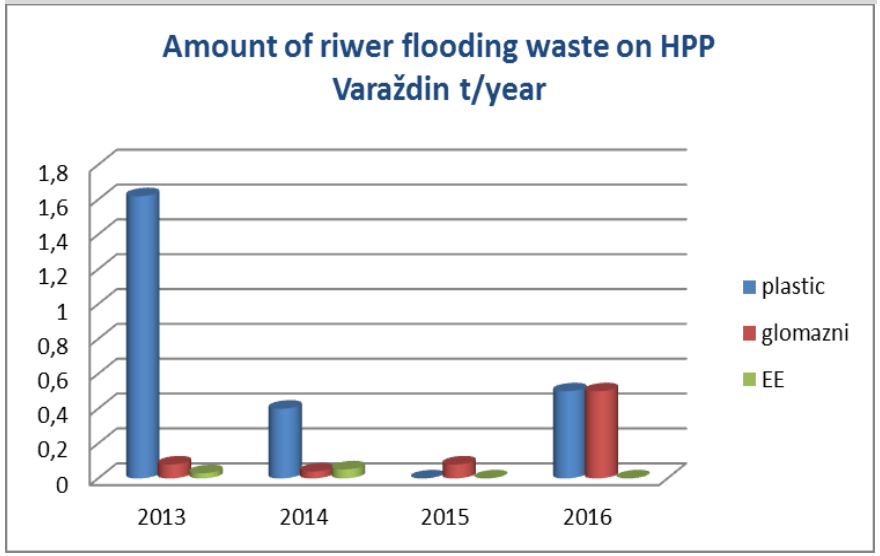
**FIGURE 8.** The types of debrise on HPP Varaždin.

- woody debris on on the banks of the riverside **is not waste** (wood, sticks, branches that falls into rivers), but it is mixed with other waste
- the woody debris should be dry and separated from other waste

| Total amount of debrise on HPP Varaždin t/year | | | | |
|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2016 |
| woody debris | 476 | 298 | 199 | 166 |
| plastic | 1,62 | 0,4 | 0 | 0,5 |
| glomazni | 0,08 | 0,04 | 0,08 | 0,5 |
| EE | 0,03 | 0,052 | 0 | 0 |

**FIGURE 9.** Thotal amount of debrise on HPP Varaždin.

**FIGURE 10.** Debrise on temporary repository HPP Varaždin.



# DEBRISE MANAGEMENT ON HPP ČAKOVEC

- get out of the water
- waste disposal in temporary repository
- drying
- selection
- transport to the municipal waste management company
- significant costs of waste management and disposal

**FIGURE 12.** Woody debrise are mixed with comunal waste, HPP Čakovec.

**FIGURE 11.** Temporary repository on HPP Čakovec.

**FIGURE 13.** The medical waste on repository in HPP Čakovec.

# DEBRISE MANAGEMENT ON HPP ĐALE

**FIGURE 14.** Clean up debrise on HPP Đale.

**FIGURE 15.** Debrise on HPP Đale.

- Permanent debrise boom – cleaning by the floating dam from the upstream side of HPP Đale and the hydraulic jack Palfinger
  - 800 $m^3$/year mixed communal waste
  - content: woody debrise, plastics, metals, textiles

# DEBRISE MANAGEMENT ON HPP ĐALE

**FIGURE 16.** Woody debrise and comunal waste on HPP Đale.

**FIGURE 17.** Temporary repository the debrise on HPP Đale.

HPP is located in the **canyon of the river Cetina.**

There is no  place for waste disposal in temporary repository.

# Results

- **Althou debrise are present on the banks of the riverside from antque, degradacion of aquatic ecosystem, particularly of shoreline areas and watercourses, has accelerated dramatically in the past three centuries as industrial discharge and runoff from farms and coastal cities has increased.**

- **During and after flooding, debrise mixed with municipal waste dramaticly increased, endangered HPPs, fields, public health and environmental safety. HPPs who are downstream of cities are significantly endangered and spend a major financial resourses to provide pruduction and safety. As anthropogenic influence encrease, debrise are proportionally encrease.**

- **The Law on Sustainable Waste Management shoud recognize debrise on watercourses and waste management, management procedure, especialy after flooding.**