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5 Success Stories on the Improved Performance of STP After the Implementation of Measures Uttarakhand

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GOPA Infra

in consortium with

FICHTNER
WATER & TRANSPORTATION

Consulting Services on Rehabilitation Measures on behalf of the National Mission on Clean Ganga

"Support to Ganga Rejuvenation"
Phase II
Uttarakhand and Uttar Pradesh

India

Indo-German Development Cooperation
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Background

GIZ's Support to Ganga Rejuvenation (SGR) Project is active in the State of Uttarakhand from 2015 and in Uttar Pradesh from 2018, providing technical assistance and support for improvement of technical, organisation and economic performance of 10 Sewage Treatment Plants (STPs) along Ganga towns in Uttarakhand.

As an output of one of the activities in SGR, recommendations were proposed by GIZ – SGR team following the assessment by National and International Experts for improvement of technical, organisational and economic performance of 10 Sewage Treatment Plants (STPs) along Ganga towns in Uttarakhand.

In continuation of the recommendations proposed during SGR, a detailed plan for implementation of the efficiency improvement measures in the 10 STPs was developed and agreed upon with the operators (Del. 4.1.2). The implementation plan was developed by the SGR team in close collaboration with Uttarakhand Peyjal Nigam (UKPJN). In order to check the status of implementation of the recommended measures and advise Jal Nigam, Jal Sansthan and the operators, a number of field visits have been carried out by the SGR team to different STPs during the course of the year 2019.

This report enlists some of the success stories on the improved performance of STPs after the implementation of suggested improvement measures in the state of Uttarakhand.

Success Story 1 - Ganga Tarang

"Centralized portal at State Programme Management Group (SPMG) level to monitor effectiveness of sewage treatment plants, STP performance, sewage pumping stations as well as the river water quality stations''

1 Background

The State Programme Management Group (SPMG) is the extended arm of the National Mission for Clean Ganga (NMCG) in Uttarakhand and has been implementing scores of Sewage Treatment Plants, Interception & Diversion Structures, Bathing and Cremation Ghats, as part of the drive towards rejuvenating River Ganga. Heavy investments from National exchequer as well as through external aided projects are being implemented on a mission mode under the flagship project titled 'Namami Gange'. As mandated, the SPMG has to ensure that the investments are effectively implemented and the assets are properly managed. However, the distance and terrain makes it physically monitor the plants on a regular basis. As requested by SPMG, GIZ-GOPA team supported SPMG & UKPJN to select appropriate Real Time Monitoring Sensors for the new plants and the ones that are being upgraded and also went ahead to develop a Central Software to track the performance of the STPs that have these sensors installed.

1.1 Challenges Faced

Many of the sensitive locations of the STPs are remotely located and are difficult to reach because of the hilly terrain and minimal road infrastructure, often threatened by frequent landslides and seasonal restrictions. The only way to keep track of the status of the plants is based on paper reports and analysis' results, which are generally submitted on a monthly basis. The situation is further complicated by the condition of the environmental laboratories and quality of personnel that man it. These constraints lead the decision makers to initiate action to monitor the effective operation of the huge investments that were made for the whole sewage management infrastructure, covering the sewage collection, conveyance and treatment systems. Further, there weren't any comprehensive mechanisms to keep track of the impact of the initiatives in rejuvenating the river water quality and bring in transparency in public reporting systems.

1.2 Solutions Offered

The SGR team at Uttarakhand in close discussion with the top management of SPMG-UK, and the state departments – Uttarakhand Pey Jal Nigam as well as Uttarakhand Jal Sansthan - advised that a **real time monitoring system** being adopted as a mandatory component of all new STPs and the ones considered for upgradation. Following GOPA team's suggestions, the state government has also initiated the proposal for upgrading all STPs with capacities above 1 MLD and at critical locations with real time monitoring systems, as well as automation/ SCADA systems to ensure remote monitoring. This proposal is under consideration of NMCG for funding. The SGR team also supported the SPMG in developing on trial basis systems for real time monitoring of water quality at the bathing Ghats and have public communication and display systems to inform public on water quality.

The **Ganga Tarang** was the key tool of the real time monitoring system developed by GOPA team, with dashboards, monitoring, tracking and warning systems for decision makers at all levels from Government to plant operators. The Centralized portal was developed for

SPMG-UK by SGR team along with Knowledge Lens Pvt Ltd and deployed on a pilot mode for implementation. The tool has capability to uplink to the Plant SCADA, acquire data from the sensors at the STPs, acquire data from various pumping stations, DG sets, water quality sensors in the river Ghats and provide meaningful analysis for decision makers. The Centralized software tool has built in big data analytics capabilities and can also track the performance level of sensors or any attempt for its tampering. It can be effectively used as a tool not just for monitoring performance, environmental compliance or contract management, but also to optimize operations and maintenance costs of the critical infrastructure from a central location as well as mobile.

The SGR team has conducted series of classroom and field trainings to UKPJN, UJS and SPMG officials to check the performance of sensors installed at site as well as the effective use of the tool in their day to day functioning. Separate sessions were organized for plant operators/ O&M contractors and vendors of real time monitoring systems. Initially, there has been some resistance from contractors to give access to internal registers or to give direct access to data from the sensors in spite of it being a contractual requirement. However, with due insistence from UKPJN officials, they have agreed to the same.

1.3 Conclusion

As on date, 10 STPs are connected on to Ganga Tarang and are being regularly used by SPMG officials, UKPJN and UJS officials as well as plant operators. Ganga Tarang is also being used by NMCG's project management team stationed at Uttarakhand for status reporting. NMCG's technical team has shown keen interest in adopting the system across Ganga states. The pilot initiative has demonstrated the capabilities and benefits of having such centralized tool, and now needs to be scaled up to convert it to a commercially viable and sustainable model. More features like inventory modules, finance modules, Human Resources modules maybe incorporated or even dovetailed with GIS based asset management systems to scale up its utility. The Ganga Tarang tool can also be effectively utilized by concessionaires/ agencies engaged as One City One Operator for holistic management of the city's sewage management infrastructure by leveraging the digital advancements in the country.

Testimonial

Shri. Uday Raj Singh, Additional Secretary, Uttarakhand Government & Programme Director, State Programme Management Group – Namami Gange, Uttarakhand

GIZ-SGR team has been supporting our team all through the last four years. They have also been supporting and handholding officials of our implementing agencies engaged in waste water management, viz. Uttarakhand Pey Jal Nigam, Uttarakhand Jal Sansthan and Irrigation Department. As the state arm of the National Mission for Clean Ganga, the SPMG-UK needs to also ensure that the sewage management infrastructure being built to protect river Ganga are effectively functioning too. However, considering the tough hilly terrains it's practically not feasible to physically monitor these infrastructure on increased frequencies.

The Central Software, 'Ganga Tarang' developed and implemented by GIZ-SGR team has become a very handy tool to monitor the Sewage Treatment Plants spread across the banks of river Ganga using I-o-T technologies and the Real Time Monitoring Sensors installed under the NMCG project in the new and upgraded STPs. As on date, we are monitoring 10 STPs using this platform and will be adding more STPs as soon as they come online. The data analytics, dashboards, reports and alerts not only help the senior decision makers in monitoring the status but is also helping the line departments for effective Contract Management; while the Plant level personnel use it for improved process control and management. GIZ-SGR team has conducted number of training programs for our officers as well as that of UKPJN, UJS and the STP operators on effective use of Ganga Tarang. Ganga Tarang has been an extremely versatile e-governance tool and has been highly appreciated by the senior administrators of the state, especially for reporting performance to judicial authorities. We have also given a link of Ganga Tarang in our website as part of our public dissemination initiative.

We understand that Ganga Tarang has features for both upward and downward integration and can be utilized to monitor and automating the functioning of sewage pumping stations as well the quality of water in the river Ghats to monitor the efficacy of the sewage infrastructure in the rejuvenation of Ganga; which we will be utilizing as the system keeps maturing.

I wish to express my appreciation for the efforts of GIZ-SGR team for this innovative and useful e-governance tool, which could also be replicated by the SPMG/ SMCGs of other Ganga States and NMCG.

Success Story 2 - Centralized Solar Sludge Drying Facility at Haridwar utilizing Advanced German Technologies

"Centralized Solar Sludge drying facility is an advanced German technology incorporating Solar Thermal Energy to convert Sewage sludge to low grade fuel quality''

2 Background

Haridwar town is one of the holiest towns in the plains of Uttarakhand and is round the year packed with people from across the world. It has great religious significance as the holy river Ganga enters the Indo-Gangetic Plains of North India for the first time in Haridwar descending from the mountains in Uttarakhand. Hindus across the globe come to Haridwar to perform their religious obligations, particularly during special occasions on festivals. Kumbh Mela is a special event that attracts pilgrims in millions.

2.1 Problems Faced

Haridwar has permanent population of about 1.9 million (as per 2011 census). The surges in floating population causes considerable strain on the water supply and sewage treatment infrastructure. Haridwar town has currently a combined capacity of 141 MLD to treat sewage emanating from the city. The new STPs that were built post year 2000 and were never provisioned for sludge management post dewatering in a centrifuge or filter press. As sewage sludge management is generally a low priority activity, most of the contractors do not operate the centrifuges properly, as they are energy intensive and expensive processes. Therefore, sewage sludge, often a slurry, was getting dumped in lowlands or open lands indiscriminately. The dumped sludge posed a threat for damaging the soil, contaminating the ground water and could get washed off to the rivers and water bodies through surface water runoffs thereby creating health and environmental hazards.

2.2 Solutions Offered

The SGR team has highlighted the risks associated with the indiscriminate disposal of sludge and have impressed upon the top management at SPMG, UKPJN and UJS the need for proper sludge management. As part of the exposure visit organized by GOPA in September 2018, the officials were taken to the plants in Gujarat where different sludge management technologies were used and they could interact with their peers.

The technology proposed was to potentially convert the dewatered sludge to a valuable resource, easy and safe to handle and acceptable to the potential buyers. Considering the local weather conditions like high solar incidence, relative humidity, temperature and wind speed, the advanced and proven German technology utilizing radiant energy from the sun was proposed to dry the sludge and provide a granulated, odourless product with guaranteed moisture levels of > 85% from dewatered sludge of 18-20% consistency. This technology, based on solar drying beds system, was developed by a German fir I+M Zizman GmbH.

Fig: Solar Sludge Drying in Process

The technology involves uniform distribution of the dewatered solids/ sludge by an automated homogenizer, followed by the interplay of utilizing the solar thermal energy trapped in the greenhouse and controlled moisture removal using guided flow of air over the sludge. If required, energy supply can be further enhanced by activating the floor heating mechanism by utilizing waste heat or with solar concentrators. The plant can be automated to advanced levels depending on the local requirements.

The calorific value of the dried sludge depends on the organic content in the sludge as available locally, to decide on its potential use as an alternate fuel.

2.3 Progress Made

UKPJN is finalizing the Detailed Project Report in consultation with the technology provider for establishment of two Solar Sludge drying plants at Sarai & Jagjeetpur in Haridwar. The implementation would be taken up post approval and sanction of the DPR by NMCG. NMCG is also keen in implementing such innovative technologies that could enhance the sustainability of the existing STPs, solve the environmental challenges as well convert the waste to a resource.

As on date, NMCG has given approval and sanction of approx. 1.2 Million € for installing a pilot sludge drying plant at Rishikesh.

Testimonial

K.K. Rastogi, General Manager (Ganga Circle), Uttarakhand Pey Jal Nigam (UKPJN), Uttarakhand

SGR team has highlighted the importance of proper sludge management and brought it in to the knowledge of responsible departments in state. They proposed a German technology to potentially convert the dewatered sludge to a valuable resource.

An interactive exposure visit was also organised by SGR team for the officials to showcase them the different sludge management technologies being used in the plants in Gujarat.

With the support from SGR team, we could now enhance the sustainability of the Sarai & Jagjeetpur STPs in Haridwar by establishing solar sludge drying plants. This will also solve the environmental challenges as the sewage sludge is currently being dumped in low lands or open lands indiscriminately that posed a threat to the Environment.

This project came out very beneficial for our departments as the consultants focus on areas that we normally ignore, and the suggested measures are easy to implement.

Success Story 3 - Capacity Enhancement of Existing STPs with Advanced German Technologies

"Capacity Augmentation of existing STPs with space constraints by utilizing advanced German technologies''

3 Background

Swargashram is a temple town, close to Rishikesh, sandwiched between the holy river Ganga and the Raja Ji National Park. Administratively, Swargashram falls in Pauri Garhwal district. Swargashram is famous for ashrams like Parmarth Ashram, Swargashram, Beatles Ashram (Chaurasi Kutia) and temples along the river front of the Holy Ganga. Apart from the residents of the ashrams and local population, there is heavy influx of pilgrims especially during Char Dham Yatra season, devotees and seekers of yoga that keep visiting the small town. Sewerage network has been laid to capture the sewage and wastewater generated by the hotels, restaurants canteens and residential complexes in the ashrams that cater to the pilgrims that throng the place. The sewage is conveyed to the 3 MLD Sewage Treatment Plant at Swargashram on the banks of river Ganga

3.1 Problems Faced

With persistent efforts of UJS, most of the sewage generators are connected to the existing sewerage network, which ultimately reaches the 3 MLD Sequential Batch Reactor based STP at Swargashram through gravity or by pumping. The treated effluents from the STP is currently discharged to the river Ganga. It has been observed that the STP commissioned in 2010 has started to get inflows of over its capacity during peak seasons.

UKPJN wants to augment the capacity of the STP to take care of the increased sewage inflow during seasonal peaks as well as the increased flow rate, as expected over the next two decades. However, there's no land available to establish a new STP given the restrictions associated with the forests in the Raja Ji National Park. The only other option available is to look out for technologies that could help enhance the capacity of existing infrastructure with the given footprint.

3.2 Solutions Offered

The SGR team at Uttarakhand in discussion with senior officials of Uttarakhand Pey Jal Nigam as well as Uttarakhand Jal Sansthan, has suggested to adapt Integrated Fixed Film Activated Sludge (IFAS) process to enhance the treatment capacity of 3 MLD Swargashram STP to 6 MLD.

IFAS offers an attached growth media in the shape of a synthetic textile, which is wastewater resistant. The material is either Polypropylene (PP) or a combination of PP and Saran (PVDC). To keep the media in the system, the textile is fixed to a e.g. Stainless Steel module. Nevertheless, the media is able to move due to the textile nature. The attached growth system reduces the scouring or simply the discharge of biomass from the treatment plant while flexibility prevents clogging.

In conventional WWTP's the sedimentation volume in secondary clarification is the limiting factor of the content of biomass in aeration tanks. The so-called IFAS process combines

suspended and sessile biomass by installing a synthetic media as growth surface for additional biomass in aeration tank. This combination enables a much higher concentration of biomass and, as well, a higher sludge age compared to conventional operation. IFAS allows a performance increase of biology up to 100% and more without any constructional measurements for volume enlargement of aeration tanks and secondary clarification.

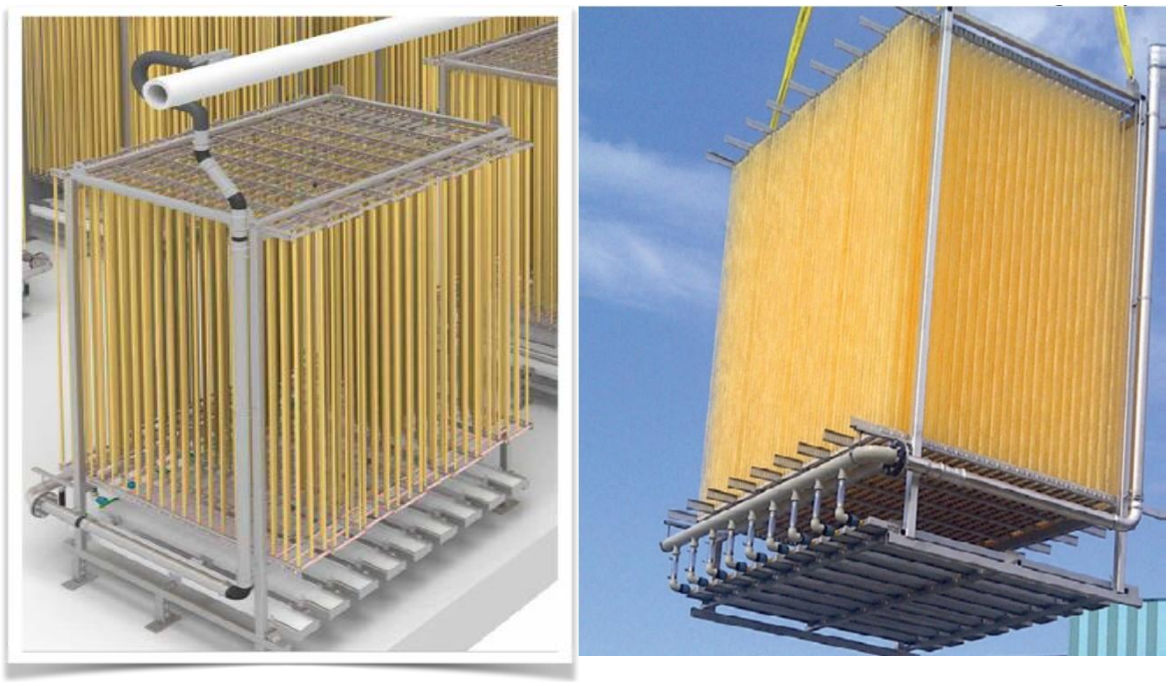

Figure: IFAS Cages with Media

The combination of German technologies proposed for optimization of the plant involved the IFAS and high-efficient Plate diffusers by Jager Umwelt GmbH, energy efficient Hybrid Blowers by Aerzener Maschinenfabrik and disc filters for tertiary level filtration.

It can hence be concluded that the existing STP's capacity can be enhanced, based on the hybrid ASP plus IFAS process with an addition of secondary clarifier, and disc filter for tertiary treatment. This will be accompanied with minor changes in electro-mechanical items and addition of a new channel for handling sewerage inflow. Tertiary treatment has been recommended to achieve a TSS < 10 mg/L in the effluent.

UKPJN is in the process of developing a DPR for submission to NMCG for funding the project. On implementation, this can become a classic case for those STPs which has to be augmented but severely limited by Land constraints.

Testimonial

K.K. Rastogi, General Manager (Ganga Circle), Uttarakhand Pey Jal Nigam (UKPJN), Uttarakhand

UKPJN wanted to augment the capacity of the Swargashram STP which is currently 3 MLD, to take care of the increased sewage expected over the next two decades as Swargashram is a temple town in Rishikesh and encounters heavy influx of pilgrims especially during Char Dham Yatra season, devotees and seekers of yoga also keep visiting the small town.

However, we were having space constraints to establish a new STP. In such scenario, SGR experts extended their support and helped us in finding the combination of advanced German technologies to enhance the capacity of existing infrastructure from 3 MLD to 6 MLD.

With persistent efforts of SGR team, existing STP's capacity will be enhanced by adapting Integrated Fixed Film Activated Sludge (IFAS) process as recommended. This project proved to be very beneficial for our department.

Success Story 4 - Sludge Management at Uttarkashi

"Improved management and handling of sludge at Uttarakashi converting sludge from a health and environmental hazard to a resource''

4 Background

Uttarkashi town is the district headquarters of the North Western district, Uttarkashi in the state of Uttarakhand. Uttarkashi town is situated on the banks of the River Bhagirathi. Uttarkashi has a hilly terrain with an average elevation of 1165 metres, its geographical coordinates are 30.73°N and 78.45°E and is remotely located at about 145 km away from the State Capital, Dehradun. This town is of great religious significance and serves as base station for pilgrims visiting Gangotri shrine.

4.1 Problems Faced

Uttarkashi town has a resident population of about 330,000 (as per 2011 census); with the floating population further straining the urban infrastructure, particularly for sewage management. The Sewage Treatment Plant at Gyansu, Uttarkashi of 2 MLD is the only sewage treatment plant to the west of Rishikesh till the Gangotri STP was commissioned. Uttarakhand Jal Sansthan, the agency responsible for Operations & Maintenance management of the STP had serious challenges with the management of the sewage sludge generated, in the absence of any functional infrastructure for it in 2016, when the GOPA team visited the site. Given the social-economic conditions of Uttarkashi and psychological aspects made sludge reuse a taboo. Further, the septic conditions developed in the sludge holding pits lead to public complaints over odour issues from the local public. The leachates that emanated from the sludge dumps had high potential of contaminating the ground water sources. Further, the sludge dumps posed an imminent threat of being washed back into the river, particularly in the monsoon season, thereby nullifying the investments made towards sewage treatment.

4.2 Solutions Offered

In Uttarakashi, SGR team consistently extended technical handholding to the state departments – Uttarakhand Pey Jal Nigam as well as Uttarakhand Jal Sansthan responsible for building and operating the Sewage Management Infrastructure in Uttarakhand. The series of support mechanisms ranged from extending advisory in selection of right technologies to that of Operation & Maintenance issues. The suggestions that were implemented include:

a) adoption of energy efficient and compact screw press for sludge dewatering
b) replacement of the damaged blowers with higher capacity blowers
c) stabilization of the sludge in dumps

Under the initiative towards upgradation/ renovation of existing sewage infrastructure along the banks of River Ganga, under the Namami Gange project; the basket centrifuge which was non-functional was replaced with screw type sludge dewatering units. GOPA team's recommendations for adoption of **energy efficient and compact screw press for sludge dewatering** and **replacement of the damaged blowers with higher capacity blowers were implemented in Gyansu STP at Uttarkashi.**

As regards to Operations & Management of sewage sludge, the immediate measures suggested by GOPA team were to ensure **stabilization of the sludge** accumulated in the dumps to alleviate the odour nuisance and soil quality deterioration. UJS officials took the initiate to stabilize the sewage sludge dumps as advised with lime addition, before capping the old dumps.

With the installation of highly efficient sludge dewatering machines, the quantity of sewage sludge generated got drastically reduced as the sludge had a 20-22% consistency, as compared to the initial 0.5% consistency. This allows a much easier and cheaper (less volume) handling of the sludge. Further, UJS officials initiated trials of using the sewage sludge as soil conditioners in select flower beds and vegetables grown in the STP premises and found them to be of visibly better quality than flowers and vegetables being grown without fertilizer. The SGR team has recommended UJS to take up further scientific studies at the Plant Research Centre at Chinyalisaur, Uttarkashi district, for impact validation and accordingly initiate communication initiatives to assuage the fears/ psychological blocks among the local community. Meanwhile, UJS has approached the district officials of the forest department to use the sludge as soil conditioner and the sludge is now reportedly been completely utilized for the various deforestation and other plantation drives of the forest department.

This has been a unique case, where sludge management was always a concern for the UJS has become now a sought-after soil conditioner. Over a period of time, this could become a resource which could provide additional revenues to the department, a step closer towards making sewage management infrastructure sustainable, upscaling the local community towards circular economy while also protecting the river Ganges from contamination from sewage sludge.

Testimonial

Mr. Baldev Singh Dogra, Executive Engineer, Jal Sansthan, Uttarkashi, Uttarakhand

We have had lot of interactions with the GIZ-Support to Ganga Rejuvenation team, and have provided us with extensive technical advisory and handholding support in adapting right technologies and cost effective solutions for upgradation/renovation of existing sewage treatment infrastructure. We had serious challenges with the management of sewage sludge generated.

SGR team had initially supported as with immediate measures for stabilizing the putrefying sludge which was becoming a public nuisance. The quantity of sludge generated has substantially reduced after installation of highly energy efficient sludge dewatering machines as advised and also made them manageable. We have experimented with the sewage sludge as soil conditioners in select flower beds and vegetables grown in the STP premises and found them to be of visibly better much better quality. After this initiative, our department has encouraged Uttarkashi district forest department to utilise sewage sludge for the various deforestation and plantation drives and there has been consistent demand thereafter for the dewatered sewage sludge.

With the help of SGR team, we are now a step closer towards protecting the river Ganges from contamination from sewage sludge. We look forward to further engagements with the SGR's project team.

Success Story 5 - Skill Upgradation & Capacity Building of UJS, UKPJN and Plant Level Personnel

"Institutionalizing Skill Upgradation & Capacity Building within UKPJN and/or UJS systems''

5 Background

Uttarakhand Pey Jal Nigam is the key implementing agency responsible for procurement, supervision and management of all water sector projects in the State of Uttarakhand. The infrastructure is then handed over to Uttarakhand Jal Sansthan for Operation & Maintenance (O&M) of the facility. Sewage Management Infrastructure has got a fillip with the Namami Gange project. However, this requires to also equip the technical officers on the specifics of Sewage Treatment and Management.

5.1 Challenges Faced

Training and Skill upgradation of the officers in UKPJN and UJS was of low priority for a long period due to reasons ranging from exigencies of work to budget constraints. Though few officers were inducted recently, there was a lack of a formal induction program / training to orient them to the tasks assigned. Further, the focus of the department was predominantly on Water Supply projects and very few Sanitation and Sewerage related infrastructure in the State of Uttarakhand, till massive investments were brought in for Sewage Management under the 'Namami Gange' project. Meanwhile, there has been considerable advancements in the technologies in Sewage Management, judicial interventions to enforce stringent discharge norms and policy interventions requiring the state governments to ensure recycling/ reuse of treated water. This essentially requires considerable reskilling of the engineering staff and officers to design, develop and manage implementation of Sewage projects, but also to have requisite knowledge and skillsets to ensure proper Operation & Management of the Sewage Treatment Systems post commissioning.

5.2 Solutions Offered

GIZ-GOPA team has devised multiple modes for ensuring skill development, after understanding the needs of the officers in UKPJN, UJS and SPMG-UK. This included a series of interactive training sessions by national and international experts, on the job handholding sessions, factory visits to witness performance tests and manufacturing/ assembly of hi-tech equipment, International Seminar on advanced Waste water technologies, Interaction meets from academicians and other sector experts and field exposure visits to other Indian states where advanced technologies to appreciate and interact with their peers.

Classroom Training - Technical

Field Training on RTEQMS

Exposure Visits, International Workshops, Factory Visits, Interactions with Technology providers, Researchers & Academia

Testimonial

Charu Agarwal, General Manager (Training), UKPJN Training Centre, Roorkee, Uttarakhand

As a Human Resources Training Center, we are keen to learn new and improved ways of working. The SGR project has helped us in this, through identification of skill and capacity gap first and then conducted various skill upgradation and capacity building trainings accordingly for UKPJN and plant level personnel.

Their teaching techniques gave us a big chance to learn new ideas and important knowledge for work at STP plants. SGR team is very supportive to all participants and provides continuous support to them.

SGR team also suggested for ToT program for key officials of UJS, UKPJN under Skill Council of Green Jobs, M/o Skill Development & Entrepreneurship, GoI PM Kaushal Vikas Yojana (UK Skill Development Mission) for in-house capacity building to train juniors and the personnel hired for plant operations recorded in GoI Register of Trainers. In this way, UKPJN's training centre can be revitalized and used as the resource centre.

I thank SGR team in totality for adopting a bottom-up approach to enhance the skills of officials. We would be happy to get support from SGR team in future.

SGR - GOPA Infra GmbH Team

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