

THE MKJ PLANT

This plant is G-force's latest design for oily waste treatment. It fits into that niche of technology where a variety of applications are required. These applications usually involve odd and difficult to treat oily waste materials that are minor, yet common, and encountered in most all waste treatment or clean-up operations. The MKJ is an LRC pre-process system that is specific for upstream treatment of our MK Series plants or complementary whereby it is used to wash, stabilize, solidify and/or neutralize dry or wet polluted solids. The MKJ primary applications fall into the following 6 categories:



1. Pre-treatment using the MKJ as a self-cleaning header box to the screen separator on the MKIII Plant. In this application the waste from pits, lagoons and lakes are pumped directly into the MKJ Bulk Hopper allowing the coarse & heavy particles to sediment onto the "L" positioned inclined conveyor and are continuously discharged through the "R" conveyor. This eliminates the accumulation of solids in process tanks and the requirement of frequent tank cleaning followed by having to deal with the disposal of these tank sludge sediments. In this mode the screen separator is installed to receive the MKJ Bulk Hopper de-sedimented liquid collected in the liquid "overflow" chamber where it is pumped to the screen deck. In this application all floating debris and fine solids are removed by the screen deck and are discharged into the MKJ "L" conveyor at the high-level point. This application allows for very fine mesh screens to be installed on the Screen Separator without fear of liquid overflow with the solids discharge. If there is liquid overflow they enter the "L" conveyor at the high-level entry port where the liquids flow back through the open center channel in the conveyor to the bulk hopper for safe containment and solids are again picked up by "L" conveyor and deposited into the waste skip or are pumped back over the screen deck with the Bulk Hopper overflow liquids. Treatment in this process is usually on a continuous feed.

2. Wet oily waste solids and wet drill cuttings. These are wastes that are a majority of solids with liquids that seep, ooze and run-off. Examples of these can be waste from oil spills (soil and oil), excavated pit bottoms of thick oily sludge with high soil content, or drill cuttings that were collected with excessive mud overflowing from the shaker screens. These high solids waste can be treated in one of two ways in the MKJ. Waste is deposited (fed) into the Bulk Hopper by drum or front end loader where it can be left static while heating (with installed heating coils) is applied to lower the sludge viscosity allowing the larger, coarse heavier soil and sand particles to sediment onto the "L" conveyor where they are removed from the free liquids. Once the bulk of coarse heavy sediments are removed, the remaining liquids can be treated with a flocculent to separate the medium size particles so they too sediment onto the "L" conveyor and are discharged. Treatment for this process is usually done on a batch basis. Each batch volume is added to the Bulk Hopper, de-sedimented and the liquid pumped from the Bulk Hopper to the screen separator for fine solids removal after which the screened effluent is ready for final process in the MK Series Plants and the Bulk Hopper is ready to receive the next batch oily waste and so forth and so on as required to handle these type waste.
3. Oily Solids Washing. Any coarse solids, sand, gravel, rocks, etc., that are coated with oil can be washed in the MKJ Plant. These solids can be loaded into the Bulk Hopper via the hydraulic drum elevator or dumped directly into the Hopper via the open hatch located on the end of the skid. Washing can be done to remove excessive oil from solids using diesel or a light crude where the solids (after washing and discharge from the MKJ) are sent for final decommissioning in a another process such as thermal desorption, bioremediation, or other approved decommissioning processes. Or, if volumes requiring washing are small and need to reach a declassification status once the washing is complete, these can be washed using an environmentally approved solids wash liquid, for example water with modified citric or acidic acid, after which the solids are ready for disposal. In both cases washing is done by dumping the oil-coated solids into the Bulk Hopper filled with the appropriate wash liquid where they are circulated and mixed in this wash liquid using the LRC Conveyors. Wash for as many circulations as required to reach the intended oil-on-solids specification. Once this specification is reached the "R" conveyor is switched from its circulation mode to discharge. The washed solids are then deposited into a waste skip for final disposal. This process is normally done on a batch-by-batch basis and so forth and so on as required to handle these type waste.
4. Waste oily solids stabilization. Solids waste contaminated with concentrations of leachable hazardous trace elements (heavy metals) that exceed environmental limits are required to be stabilized using metals bonding agents before disposal. Today there are metals bonding agents approved under the USEPA and EU Regulatory Commission, which are designed to meet Universal Leachability Specifications for a 1000-year regression period. These bonding agents are simple and economical to apply using the MKJ. The standard procedure for application is to test the waste to first determine the degree of their metals concentration levels and leachability. Once tested, and if exceeding the regulatory limits, bonding agent application rates can be calculated and laboratory tested on the sample before actual field application. Normal dosage rates for bonding agents are from 1.0% to 5.0% per mt of contaminated waste. This is equivalent to 10 kg/mt to 50 kg/mt of bonding agent at a cost from \$2.00/mt to \$6.00/mt. The application is carried out in the MKJ by first filling the Bulk Hopper with the contaminated waste and, while it is circulating with the LRC Conveyors, to add the bonding agent in its prescribed dosage using the MKJ Dry Chemicals Dosing Hopper. The circulation rate in the MKJ allows for thorough blending of the bonding agent with the waste solids in about one hour per each batch. Once the blending is complete the materials are safe to

discharge from the MKJ via the “R” conveyor into the waste skip for final disposal. This process is done on a batch-by-batch basis.

5. Waste oily solids solidification. This usually involves waste that are primarily solids, but wet with oily liquids that need to be bound before disposal. Solidification is an older and outdated treating method that uses lime, cement, silica, and the like to solidify the wet waste into a solid mass. The negative aspect of this treatment is it adds substantial volume (lime, cement, etc.) to the existing waste to achieve its state of solidification. This bulking requirement opposes waste minimization, which is one reason we do not recommend this treatment method. The process is only a temporary fix in that the regression timeframe of these binding materials is short, 20 to 40 years, after which the materials must be again collected and re-processed. The treatment process is similar to stabilization except that the additive volumes can range from 25% to 50% or 250kg/mt to 500kg/mt. Therefore when mixing, this volume needs to be calculated so that the correct ratio waste:additive can be accommodated in the Bulk Hopper's allocated space. Because of the large volumes of solidification additives it is best they are dumped into the Bulk Hopper via the open hatch using a front-end loader. The waste materials are added first with the LRC Conveyors in the circulation mode. The solidification additives are then added while observing the mix. Once the mixed materials reach the correct consistency (usually determined by pilot testing on a representative waste sample) the solidified mass is discharged via the “R” conveyor for disposal. As we have pointed out solidification is a method we do not recommend however we have included it in this brochure to illustrate to operators, still preferring to apply this treatment process, that solidification can be accommodated in the MKJ. Our alternate recommendation for treating these type-wet solids is bioremediation. Our bioremediation brochure is provided on our WEB site under “E-remedies” if one is interested to review this process. Therefore instead of solidification we recommend to treat oily solids using compost bioremediation and this applies for all solids separated in the MKJ and in the MKIII series plants.
6. Waste solids neutralization. When treating solids waste it is important to take a reading of the pH. If the solids waste pH is significantly acid or alkali this can be neutralized in the MKJ with the addition of approved acid or base treating chemicals. Normally acids are treated using the liquid chemical dosing system and bases are treated using the dry product-dosing hopper. To determine if the waste should be neutralized a representative sample is collected, prepared and tested using a pH meter. Depending on the pH range, 6 to 8 is generally an acceptable. If however the pH is high or low requiring adjustment, the sample can then be dosed to determine the volume of agent needed to neutralize the sample. Sample test dosage will correspond to the full batch treatment whereby it can be calculated to attain the full batch dosage volumes required. Then with the waste circulating in MKJ the additive can be added over one or two circulation (20 to 40 minutes) to neutralize the batch. To confirm neutralization, sample the treated batch then prepared and test it again using a pH meter. The pH should be in the 7 range. After that the material is ready for disposal into the waste skip with the “R” conveyor, or for any remaining treatment should metals stabilization or bioremediation be required on the same neutralized batch.

PRINCIPLE OF OPERATIONS

These principles have been outlined in general on the above 6 points. The MKJ is fitted with all the required components to service those processes as described. It has 2 liquid storage tanks for water and separated liquid waste. It has a receiving hood for the addition of drums, which is fitted with a nozzle misting system to dampen and sequester any dust. The feed opening for the front-end loader bucket is closed unless products are being added, when it is opened. It too is

fitted with a nozzle misting system to dampen and sequester any dust. All tanks are fitted with high level and low level switches to prevent overflowing of tanks and off pump when the tanks reach empty for operational protection. When these levels are reached a safety warning light is activated and an alarm is sounded so the operations can be stopped and the situation corrected. The entire installation is Exd according to the EU ATEX 2 zone rating.

INSTALLATION & SERVICEABILITY

G-force plants are supplied with one-year of spares and come with a recommended maintenance schedule. All primary equipment is supplied as a complete package including special tools and is ready for installation on a level concrete pad. **G-force** provides its engineer to supervise the plant installation and commissioning on site, which normally takes ~7 days. The client is expected to provide a level plant installation concrete pad (all civil data are supplied by **G-force**), a 15 ton forklift to unstuff the shipping containers, and a 50 ton crane to lift and place all the plant modules into place on the concrete pad. Installation tools and special equipment servicing tools are also provided with the delivery of the plant. Immediately following plant commissioning the actual operations are ready to commence. No other requirements for installation are needed except for the client to bring service points (electricity, water, and separated liquid take off pipes) to and from the concrete pad for hook up purposes. **G-force** provides all utility details and connection points so that the civil contractor can have those ready once the plant arrives. If required **G-force** also supplies all climate buildings dimensionally specific for the plant footprint as delivered. Following plant-commissioning **G-force** will provide on site training to the clients assigned Plant Operator to insure a smooth handover. This is done by arranging training contracts with clients whereby our operations engineer remains at the clients site for as long as necessary to train the local staff up to operational competence and full take-over. In our experience we have commissioned plants where the clients engineers took over immediately after commissioning, this we consider exceptional. For this MKJ Plant we expect the local engineers to reach operational competency after two weeks of training and operation.

DIMENSIONS & UTILITIES

Basically the only utility requirements are electrical power and plant operations water. If the client has waste materials requiring heat to insure operational performance this can be provided by **G-force** with the supply of a hot water boiler. If the client has steam available we can provide our steam to hot water converted. The kW and water requirement depend on plant size, materials to be treated and options chosen, details of which are provided with our full quotations. For the MKJ plant shown in the photo the electrical requirement is 30 kW of installed power and the footprint is ~L12m x ~W5m. Quotations giving budgetary prices with full site layout drawings, P&ID and GA drawings, consumables, manpower and the rest are provided on serious inquiries.

DELIVERY TIMEFRAME, PLANT CERTIFICATION & EQUIPMENT WARRANTIES

Delivery, from the time of approved order placement up to ex-works, requires **G-force** 18 weeks to construct the plant shown in the photos. It is the policy of **G-force** that before shipment the plant is fully assembled at the factory so that it undergoes a complete Factory Mechanical Completion Certification. The buyer is asked to attend this certification. During the last 7-day period of plant fabrication **G-force** invites the Buyers assigned operation engineer to our manufacturing facility in Holland for schooling and hands on training at our cost. The MKJ Plant is delivered with a Mechanical Warranty to certify that the plant is under warranty for 100% of the supply against any defects for the first year of operations, starting from the date of commissioning, or for a period of 18 months from the date of ex-works delivery, whichever comes first.