

Yukon Placer Mine Study For Increasing Gold Recovery

Placer Gold Recovery Research Final Summary

Sluiceboxes can provide a much higher concentration ratio than most other gravity concentrators at very high overall placer gold recoveries (as much as 99.9%,K90). They are also very reliable, inexpensive and simple to operate. This combination is very difficult to beat and explains why the sluicebox is still the most important placer gold concentrator in the Yukon.

In 1989 and 1990 Clarkson conducted 30 radiotracer tests at 24 placer mines. For each test, 100 placer gold particles from four size ranges (1.4, 0.72, 0.36 and 0.18mm or +14 to +100 mesh) were irradiated in a nuclear reactor. These tracers were thoroughly mixed with pay gravels and salted into the sluicebox's feed hopper 12 to 24 hours before clean-up. At clean-up, scintillometers were used to detect the very low level X-ray and gamma ray radiation emitted by these tracers to locate them in the sluice runs.

At every mine the gravel feed rates, water flows, equipment dimensions and riffle performance were measured. After the gold tracers were removed from the final concentrate and counted, the concentrate was sieved and weighed. These gold recovery, weight and sieve data were used to calculate the quantities and size distributions of the gold particles in the original pay gravels and those lost in the tailings. The expired tracers were stored in a lead lined container until their radioactivity was near background levels (about 2 months).

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Effect of Screening on Gold Recovery

The data clearly demonstrates the effect of screening on gold recovery. The averaged gold losses of mines with unscreened single-run and triple-run boxes were ten times higher than those with screening equipment. When pay gravels are screened before sluicing, gold recovery is improved dramatically, barren gravels are eliminated from the feed, and riffle wear is reduced. Screens also improve washing by breaking up clumps of clay and cemented particles.

Effect of Riffle Type and Matting

Coarse (10H and 4-6 Lb/square foot) expanded metal riffles are effective at recovering gold particles finer than 1mm, however one inch angle iron riffles are required to efficiently recover gold coarser than 1mm. Coarse gold (+1mm) losses with expanded metal can be very dramatic as the particle size increases.

Angle iron riffles require higher water flows (320 gpm), steeper gradients (3 in/ft) and specified gap[s] (1.5 to 2.5 inches) and inclinations (-15 degrees) for optimum gold recovery. One inch angle iron riffles do not tend to pack as readily as larger angle iron riffles.

Unbacked Nomad matting appears to be the best matting in common use because it does not interfere with riffle operation, most of its volume is available for gold storage, it does not release entrained gold particles in a sluicibox and it is easy to clean. Cocoa matting, astro-turf and Monsanto matting are not recommended.

Effect of Feed Rate On Gold Recovery

Pay gravel feed rates which exceed 100% of recommended values (8 loose cubic yards per hour per foot of sluice width for expanded metal riffles, 16 for one inch angle iron riffles) are one of the greatest factors contributing to gold losses. Water flow rates which are less than 100% of recommended values (160 gpm/ft of sluice width for expanded metal riffles) or more than 250% of recommended values also reduce gold recovery. These recommended rates have been confirmed in three years of field testing by Clarkson and in laboratory testing by Poling and Clarkson.

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Oscillating Sluiciboxes

An oscillating sluicibox may be an advisable alternative for pay gravels with a high proportion of clays or heavy minerals which would otherwise pack the riffles of a conventional sluicibox. When riffles are packed, gold particles are unable to pass through to the matting resulting in extreme gold losses. An oscillating sluicibox has its sluice runs suspended from cables and is oscillated in a horizontal circular "panning" motion by the rotation of a motor driven eccentric.

For example: Placer Operation Processing 32 Cubic Yards/hr., Through The Box.

Screens material to 1" minus.

The first sluice box run is 2' wide X 8' long of 1" angle iron riffles over Nomad matting, sloped 2-3"/ft.

The sluice box that follows is 2, 2' wide runs, 12' long of expanded metal over Nomad matting, sloped 1-2"/ft.

Water is a 6" pump delivering 900 gallons/minute.

The first box is getting 16 CYPH/ft. wide and 450 gpm water/ft. wide.

The second box is getting 8CYPH/ft. wide and 225 gpm water/ft. wide.

In this case we have a lot of water so we may run the boxes a little flatter. The material being run will determine the need to use more or less water and more or less slope on the boxes. Put your hand down in the riffles and see if they feel "active". Are the little rocks bouncing around, if so that's good. When you shut down examine the riffles. If they are packed and the material beneath each one is packed hard you should try making the sluice box a little steeper. If there is almost no material left in the riffles, you have to make them a little flatter or cut down the quantity of water. Look at the expanded metal riffles. Same principles apply. They will not have much material in them, but you should see some heavier concentrate held there. If not, then again you have to flatten the box and /or reduce the water.

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These principles have to be understood, and practiced. No one can write the perfect design for all placer miners and their creeks. Each miner has to analyze his process results and change his procedures to fit his conditions. No two mines are identical. The Canadian study was professionally done and gives us a good starting point. Most plants I purchase for Sale will have these design features incorporated when practical.

Notes:

I don't like boxes over 30" wide. There is a tendency to channel.

Some materials just run slow and you have to watch your box to make sure you are not over feeding it. If you see the level of water in the box rising, it means the gravel has buried the riffles and they are no longer active and effective. Slow down, and if necessary make a marker on the first box with riffles so you can keep the feed down to an appropriate rate. Sometimes in real sandy material, everything put on the screen goes through and you are processing much more than usual, from other parts of the same cut, and it sneaks up on you. You have to pay attention.

Never think you will get all of the gold. It won't happen. Don't freak out when you pan the hole at the end of your boxes and find a few fine colors. Catching those is probably going to be an exercise in losing money.

Gold at the lower end of your last box is cause for investigation. Pull the last pieces of Nomad matting and pan the concentrate and see if the gold is significant. If so you've got a problem in the system; you are not cleaning up often enough, you have some thin, flat, hard- to catch gold, or you overfed the system. I have overfed to the point I could track a stringer of gold all the way out the end. When I start loading the pay streak or the ground I expect to be the best pay, I slow down.