

EJECTOR SOLUTIONS

for

NUCLEAR WASTE



DECOMMISSIONING

Slurry Handling

Tank Mixing

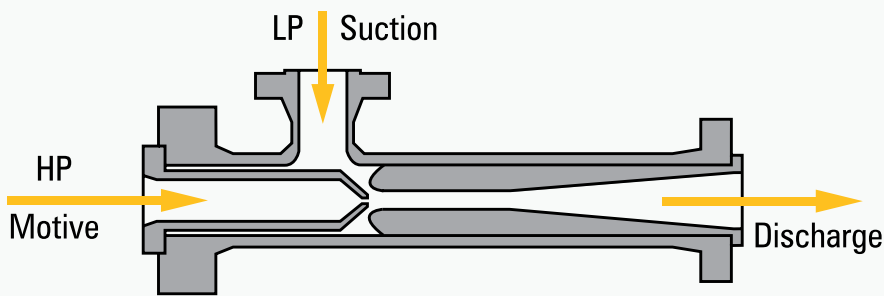
Test Facilities

R&D Consultancy

How an Ejector works



Transvac Nuclear Slurry Ejector complete with wear resistant ceramic internals



“Ejectors use high pressure (HP) fluid to compress low pressure (LP) fluid to an intermediate level”

Terminology: Ejectors can also be referred to as Eductors, Injectors, Jet Pumps or Jet Syphons.

Depending on the application, different fluids can be used to provide the motive energy.

Normally Ejectors are pipeline mounted, but for some applications they are submerged within the process fluid (for example nuclear waste slurry tanks).

Connections are flanged or butt welded as standard.

Why use Ejectors?

- ✓ Environmentally friendly - zero emissions
- ✓ No maintenance
- ✓ No moving parts
- ✓ Proven reliability
- ✓ Easy to install
- ✓ Simple to control
- ✓ Low cost & weight
- ✓ Low noise levels
- ✓ Safe to operate
- ✓ Can be installed in tight spaces
- ✓ Handles solids, two phase flow and liquid slugs without damage

		Suction Fluid	
		Gas	Liquid / Slurry
Motive Fluid	Gas	Air Jet Ejectors use pressurised motive air to evacuate air from closed vessels for indirectly transfer liquids or slurry. For pumping small quantities over short distances.	Gas Jet Syphons use pressurised motive air to directly transfer liquids or slurry. For pumping small quantities over short distances.
	Liquid	Liquid Jet Exhausters use pressurised liquid to evacuate air from closed vessels for indirectly transfer liquids or slurry. For pumping small quantities over short distances.	Liquid Jet Pumps use pressurised liquid to directly transfer liquids or slurry. Suitable for transferring large quantities of slurry over long distances.
	Steam	Steam Jet Ejectors use motive steam to evacuate air from closed vessels for indirectly transfer liquids or slurry. For pumping small quantities over short distances.	Steam Jet Syphons use motive steam to directly transfer liquids or slurry. For pumping small quantities against low discharge pressures

Research & Development

Transvac has a new state-of-the-art Research & Development facility adjacent to its manufacturing workshops in Alfreton, Derbyshire.

Transvac Ejectors for the nuclear industry are all tested prior to despatch.

Recent projects include developing and performance testing various Jet Pump designs for the Sellafield SIXEP and SPPI projects.

The test facility includes a number of water and slurry flow loops, a solids separation system, automated valves and data acquisition for both pipeline and in-tank mounted Jet Pump testing.

Transvac can fully performance test Ejectors using water and slurry simulants, including duty and off-design operating points.

Transvac research & test programmes are supported by CFD studies and fundamental University research.



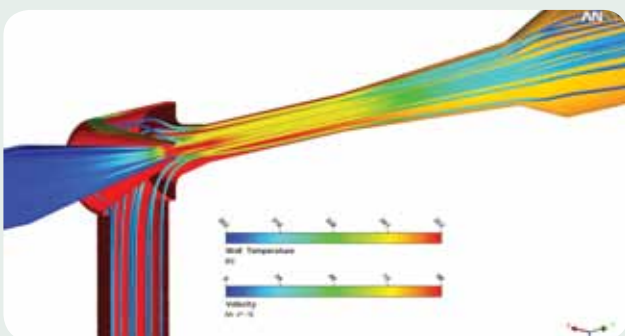
Transvac's new Research & Development Facility



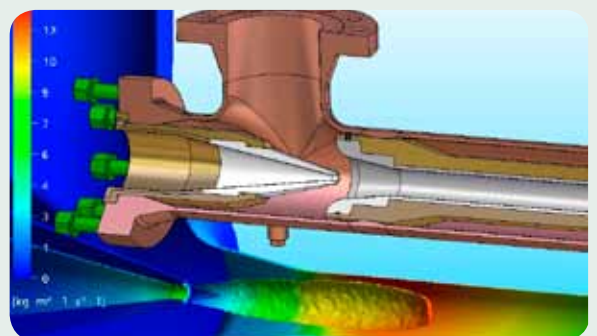
Test Rig Layout



Transvac's new Research & Development Facility



CFD Ejector Modelling



Sand Slurry Ejector CFD Modelling

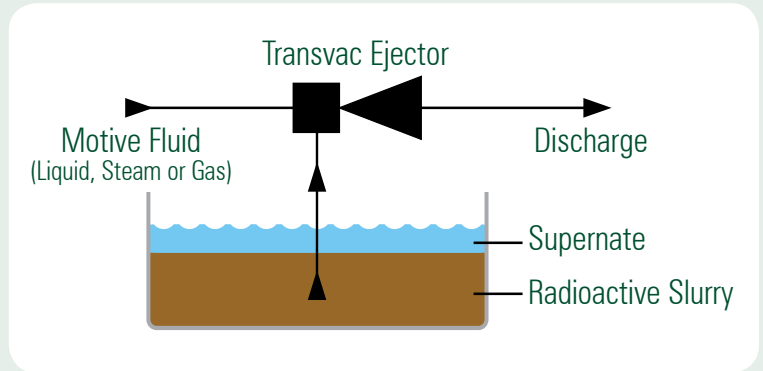
Slurry Handling

Direct Pumping of Nuclear Waste

Typically motivated by pressurised water, Liquid Jet Pumps can be used to entrain and transfer radioactive waste from settlement tanks / ponds.

Liquid is often used to transport radioactive slurries in order to maintain velocity within long discharge pipelines and thereby prevent solids settlement.

When pumping abrasive slurries, materials are typically stainless steel complete with ceramic internals.

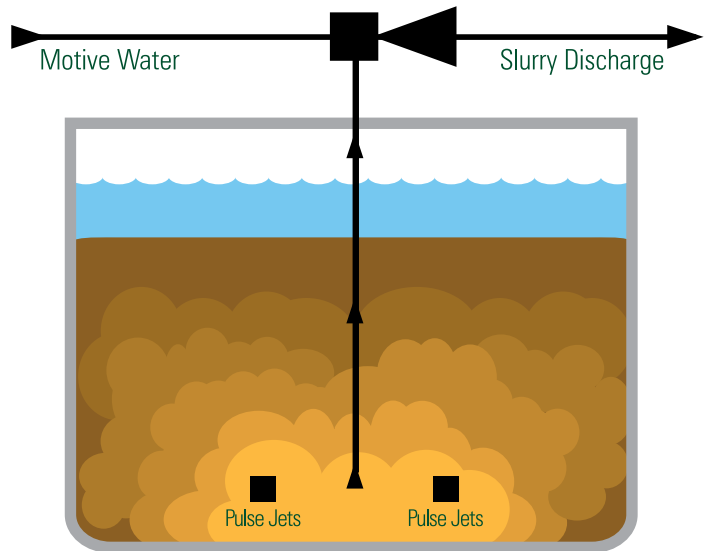


SPP1 Application

For the SPP1 application Transvac Liquid Jet Pumps are installed above the radioactive slurry.

In operation 'Pulse Jets' submerged in the slurry agitate an area around the suction 'leg' of the Liquid Jet Pump allowing it to transfer slurry to reception tanks elsewhere on site. As the tank slurry is removed liquor is added to the tank to maintain a constant head.

The SPP1 Jet Pumps include Transvac ceramic internals to resist wear.



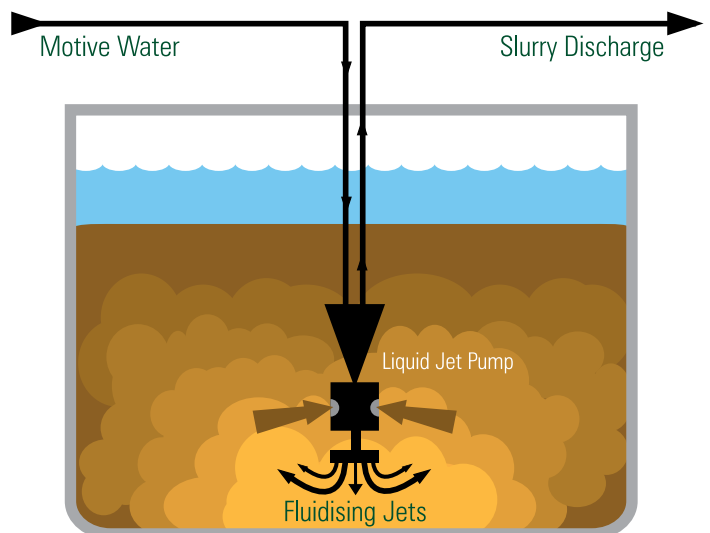
SIXEP Application

For the SIXEP application Transvac Liquid Jet Pumps complete with a special fluidising jet systems are to be submerged in the radioactive slurry.

In operation the fluidising jets agitate an area around the suction ports of the Jet Pump allowing it to transfer slurry to reception tanks elsewhere on the site.

As the tank empties the Jet Pump and fluidising jets are gradually lowered.

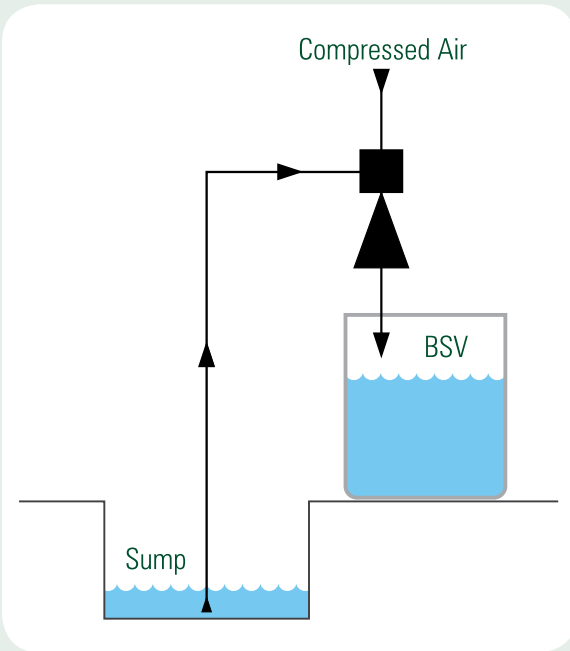
The SIXEP Jet Pumps includes Transvac ceramic internals to resist wear.



SPP1 Buffer Storage Application

Transvac Air Jet Syphons are used to decant (directly transfer) radioactive magnox liquor from cell sumps into the BSV tank as shown in the diagram.

Using compressed air as the motive fluid enables the transportation of radioactive liquor without adding any extra fluid to the quantity handled.



Butt welded Ejector with flanges fitted for hydrotest - Dounreay

Steam is a very effective medium to motivate Ejectors when directly pumping radioactive slurries over short distances. One advantage of using steam is that it is easy to provide and adds very little additional liquid to the radioactive slurry being pumped, which can be a major benefit for downstream processes. Typically discharge pressures would be >2 barg.

Gas is not an effective medium for directly entraining and pumping liquids. It can only be used as the motive fluid for Air or Gas Jet Syphons when entraining and pumping small quantities of liquids / slurries over short distances.

SPP1 Buffer Storage Application

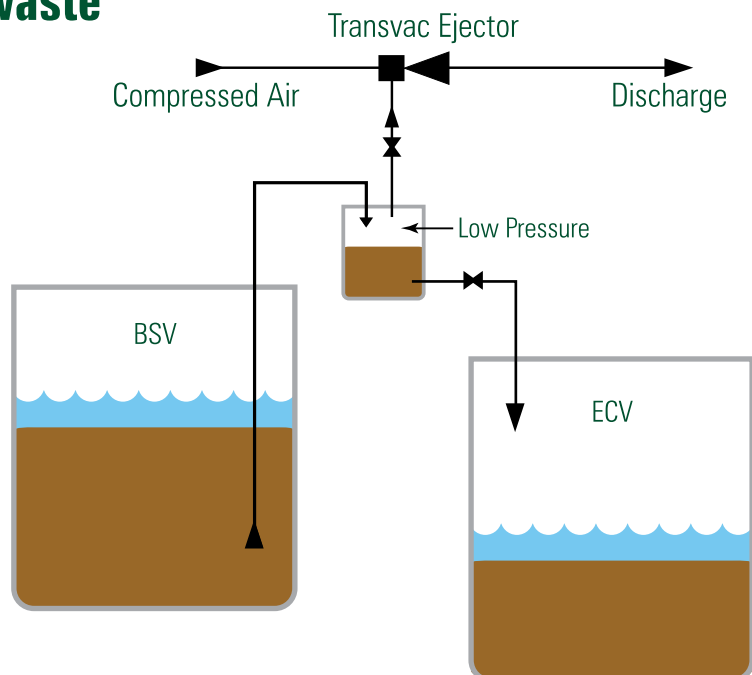
Following on from the Direct Lift Ejector, the Transvac Air Jet Ejector (AJE) again uses compressed air as the motive to draw air from the system. As is shown in the diagram below.

Indirect Pumping of Nuclear waste

Steam, Air or Nitrogen can be used to motivate an Ejector to create a vacuum within a transfer vessel to draw in liquids / slurries. Steam, Air or Nitrogen is not in direct contact with the fluid being pumped.

Once the volume of liquid reaches a preset level in the transfer vessel the Ejector is switched off. The vessel contents can then be simply drained by gravity to the discharge point.

This system is usually used for transferring small quantities of suction fluids.



Other Ejector Solutions

Jet Mixers for Tank Mixing

Tank Jet Mixers provide a simple method of mixing and agitating tanks with no in-tank moving parts and no maintenance.

Performance is controllable by adjusting the motive fluid flow provided by an external pump.

Each Tank Jet Mixer is designed to suit the process mixing requirement and single Mixers or a number of mixers mounted on an in-tank manifold are available.

Transvac can offer the basic mixers or a complete system including pipework, pumps and valves. Materials of construction can offered in most materials including ceramics.



Tank Jet Mixer Nozzles

Advantages of Jet Mixers

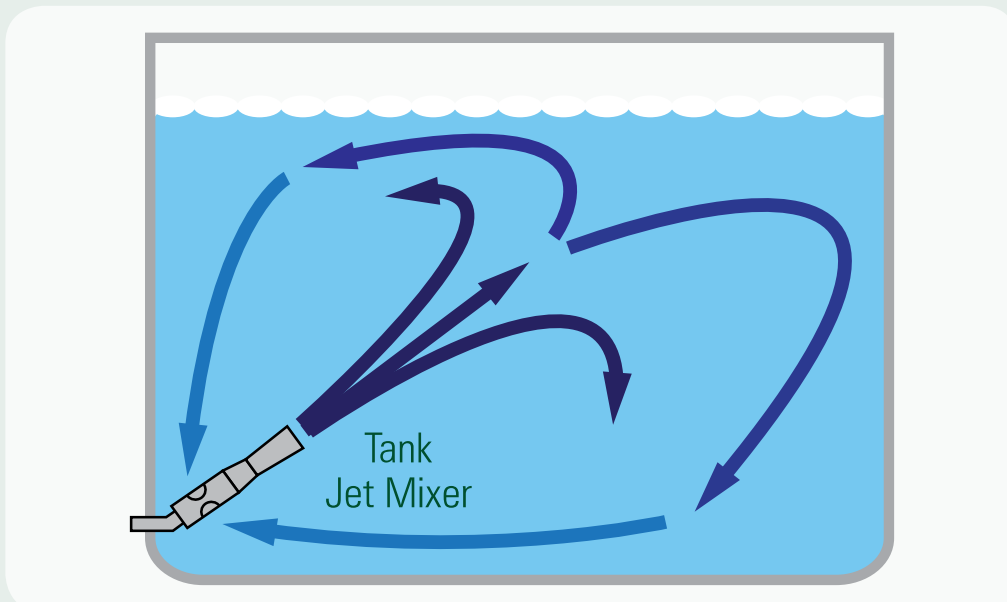
- ✓ No moving parts
- ✓ No splashing or aerosol created
- ✓ Operates at variable depths
- ✓ No bridges or bearings used
- ✓ No in-tank maintenance needed
- ✓ Evenly distributes mixing
- ✓ Controllable mixing
- ✓ Simple, reliable and robust



Jet Mixing System in tank



Jet Mixer on tank support



transvac

the world's leading
supplier of innovative,
custom designed,
ejector based solutions

Transvac has over 40 years experience supplying Ejector solutions. This knowledge and experience is invaluable because it enables Transvac to produce Ejectors using the very latest Ejector design and construction techniques.

As a fully integrated modern in-house Ejector manufacturer, Transvac maintains full control over process and mechanical design, supply of raw materials, manufacturing, scheduling and testing.

Each Ejector is custom designed specifically to suit each customers individual process requirements to ensure maximum operating efficiency. Transvac can also undertake a design study to assess the viability of using an Ejector for a specific application.

Mechanical Design Standards

Transvac Ejectors are designed and manufactured in accordance with recognised national and international design codes such as ASME VIII Div.1, PD5500, ASME B31.3, RTOD etc. supported by in-house FE analysis and full non-destructive testing.

Transvac has dedicated facilities to work with Duplex, Super Duplex, Stainless Steel and Carbon Steel to NORSOK and NACE standards.

Quality

All Transvac's design and manufacturing processes are quality assured and certified to BS EN 9001 and module H of the PED (Pressure Equipment Directive - EU Standard). Transvac is also registered with Achilles and FPAL



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