An Innovative Approach to Sludge Retrieval from Containers at K Basin

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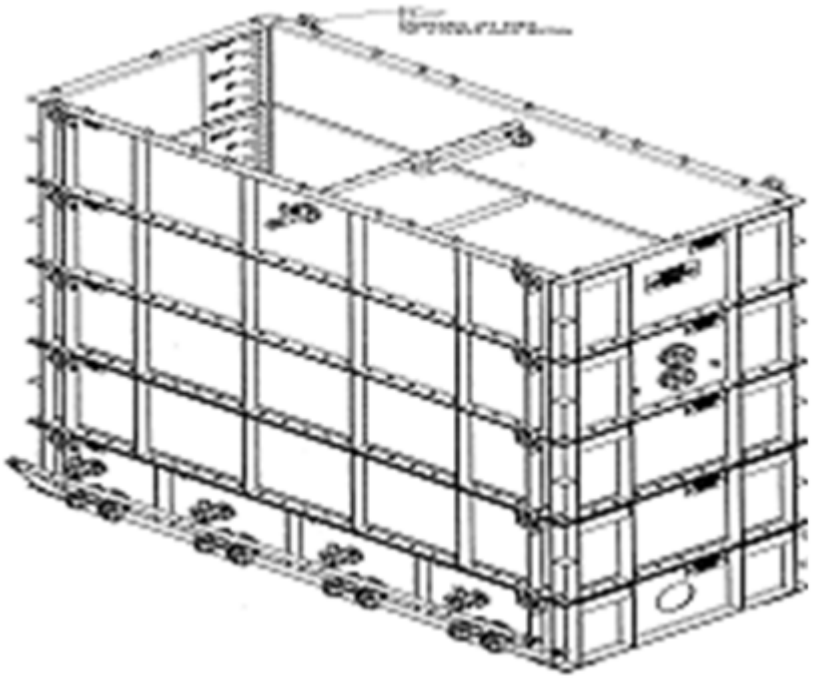
Overview and Summary

- NuVision Engineering has successfully demonstrated through proof-of-principle trials, an alternative approach to sludge retrieval from the top of K basin containers
- The approach is based on proprietary technology from the UK
- Prototypical trials are approaching completion May 2009 and it is anticipated that a complete system will be designed and demonstrated on a full scale in the next year

Overview and Summary

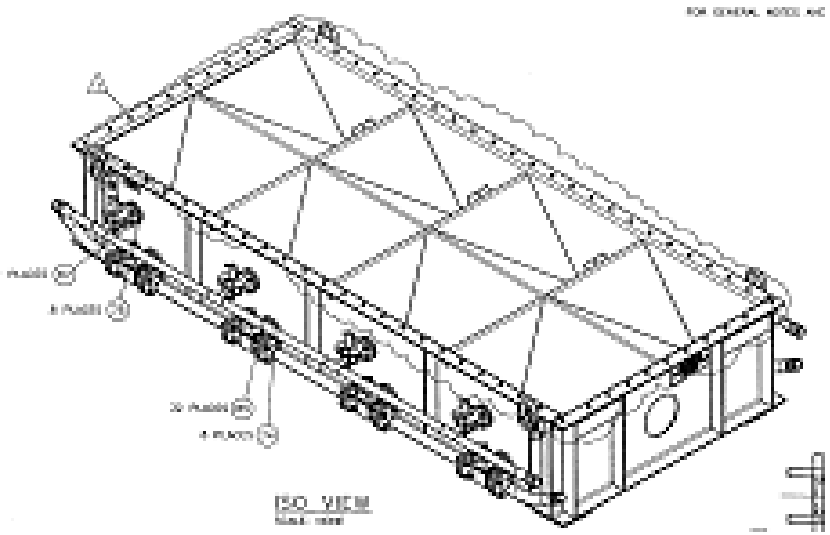
- Excellent example of
  - fast paced teamwork between NuVision Engineering, EM21 and the site contractor, CH2M Hill Plateau Remediation Co
  - the advantages of applied R&D

The Challenge 1



- 6 Containers – 8 compartments
  - ~ overall 12 ft x 6 ft x 13 ft deep
- Baseline method of sludge retrieval relies upon manifolded arrangement connected to a centrifugal pump – Sludge removed from base of container
- Objective of this work is to provide and demonstrate an alternate method of emptying the K-East Basin Sludge from the top of the containers

The Challenge 2



GA of Tank Base

Plan view of one of eight compartments

The Challenge 3

- Simulant Formulation

KE Basin Container Sludge Simulant (#11 – modified rheology simulant based on 93 vol.% KE floor sludge and 7 vol.% KE canister sludge)

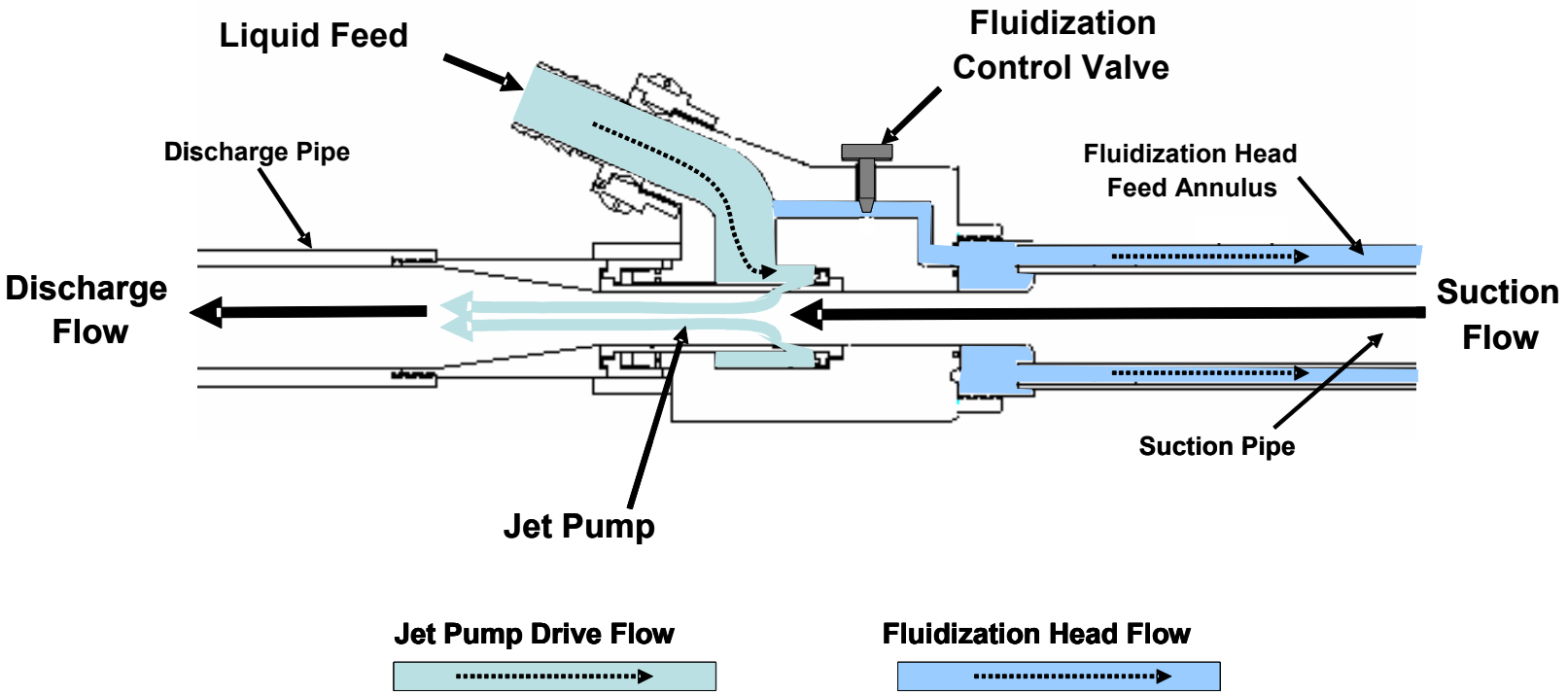
Material	Amount, wt. %	Particle Size Specification
$FeOOH$ or $Fe(OH)_3$	32.1	$d_{10} = 6\ \mu m$, $d_{50} = 13\ \mu m$, $d_{90} = 19\ \mu m$
Sand	24.1	$d_{10} = .17$ mm, $d_{50} = .30$ mm, $d_{90} = .56$ mm
Aggregate	14.3	$d_{10} = 2.0$ mm, $d_{50} = 2.8$ mm, $d_{90} = 4.0$ mm
$Al(OH)_3$	12.1	$d_{10} = 2\ \mu m$, $d_{50} = 13\ \mu m$, $d_{90} = 47\ \mu m$
CeO_2 or equivalent	12.1	$d_{10} = .5\ \mu m$, $d_{50} = 4\ \mu m$, $d_{90} = 19\ \mu m$
Steel Grit or equivalent	4.1	$d_{10} = 1.9$ mm, $d_{50} = 2.3\ \mu m$, $d_{90} = 2.7\ \mu m$
Dense metal or alloy	1.2	$d_{10} = .30$ mm, $d_{50} = .60$ mm, $d_{90} = 1.41$ mm
Total	100.0	$d_{10} = 4\ \mu m$, $d_{50} = 20\ \mu m$, $d_{90} = 2.6$ mm

- Current sludge depth varies in the range of 1-6 feet

Test and Demonstration Program

- Proof of Principle Trials
  - Use available "Shop Test Unit" and single supply feed
- Prototypical Trials
  - Redesigned retrieval system
  - Prototypical Simulants
  - MASF testing to support TRL level 3 determination
  - Additional testing with refined objectives

Top retrieval unit - HydroLance

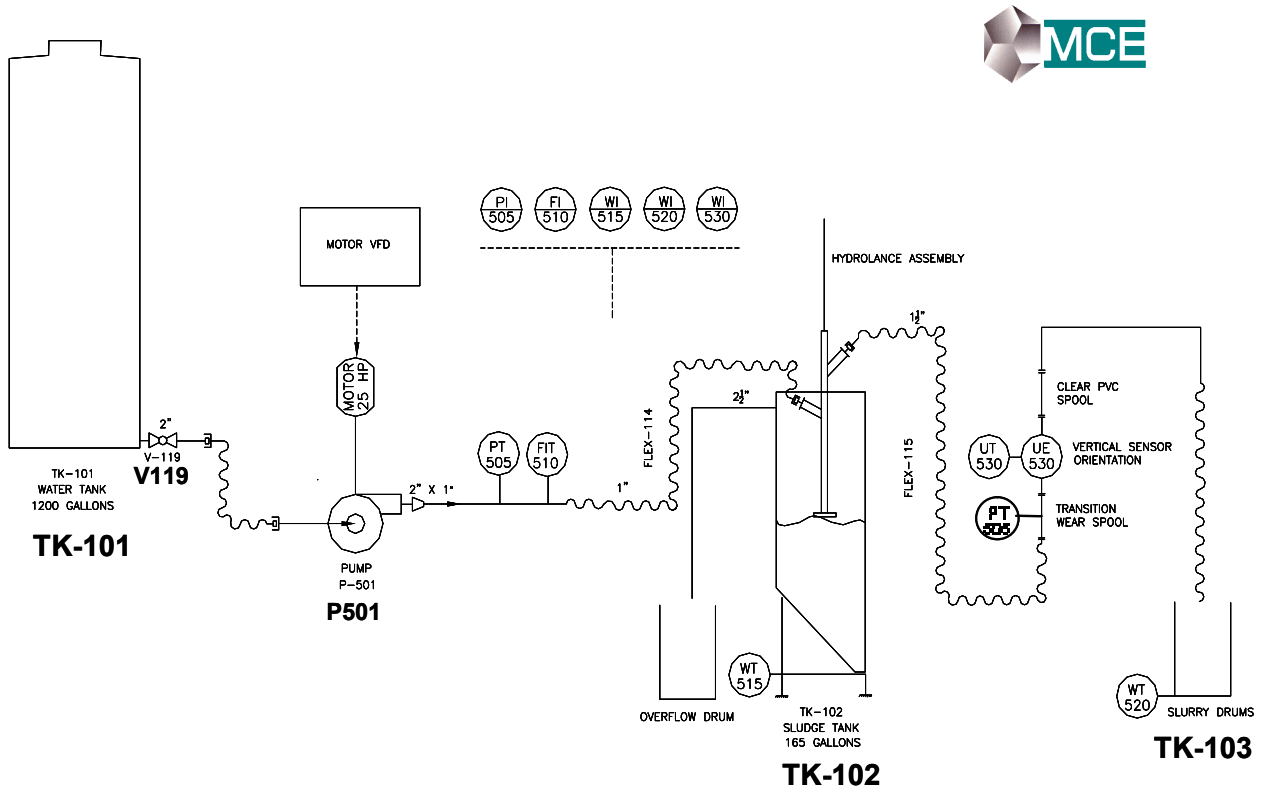


Benefits of HydroLance

- Focused “zone of influence”
  - Mobilization and retrieval using minimum water
  - Independently adjustable mobilization and eductor suction flows*
- Demonstrated ability to handle high solids concentration without blocking or loss of performance
- Simple construction allows fabrication from materials with higher erosion resistance

*Purpose built unit used for Prototype trials

Proof of Principle Trials 1



Proof of Principle Trials 2

Proof of Principle Trials 3

- The proof-of-principle trials confirmed that the available “shop test unit” HydroLance was capable of acceptable levels of retrieval and transfer of sand slurry at an acceptable mass dilution ratio.

- Significant variation in the required HydroLance feed water volume were indicated and were assumed to be due to a worn feed pump.

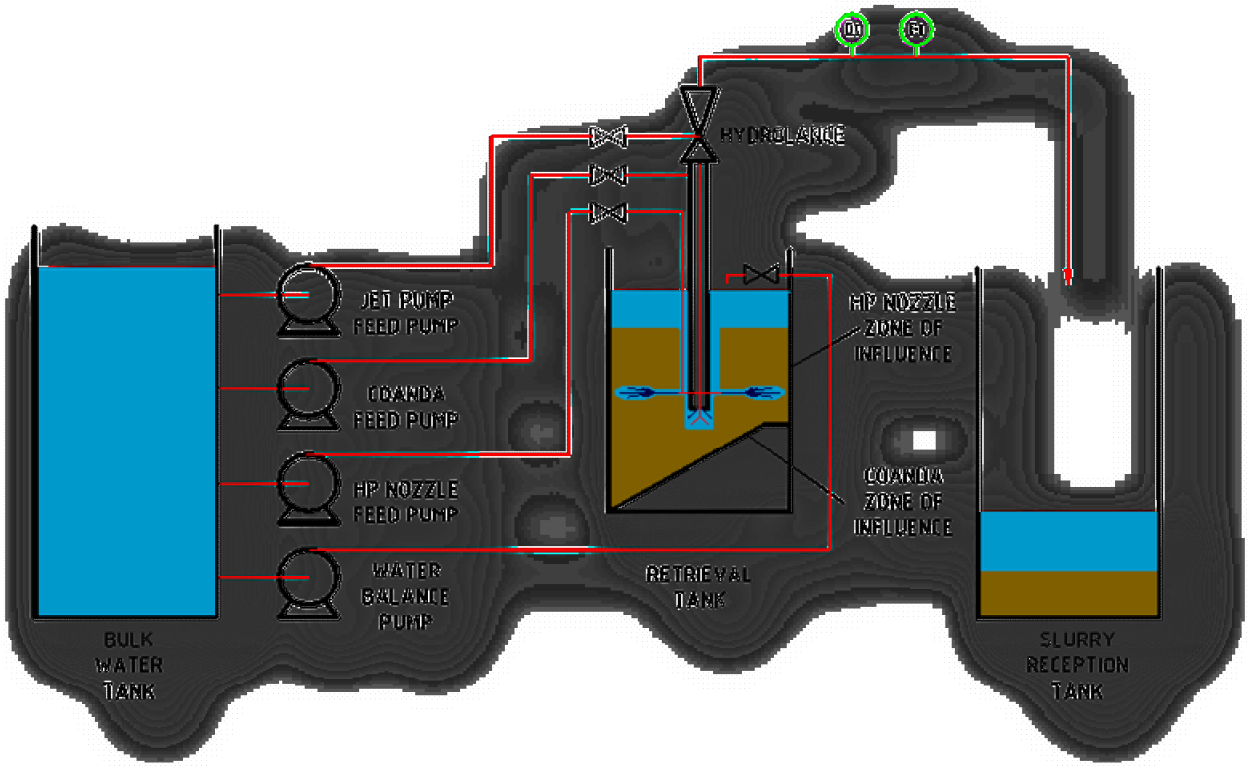
Proof of Principle Trials 4

- Although shown to provide successful transfer of sand slurry, the zone of influence of the proof-of-principle HydroLance units fluidization head needs to be increased to meet the container simulant requirements.
- Final proof-of-principle trials confirmed that modifications to the HydroLance fluidization head would provide significant performance improvements.
- The HydroLance, fitted with the Coanda fluidization head, was capable of picking up and delivering 100% of the largest and heaviest tungsten components used in the container simulant formula.

Prototypical Trials 1

- Equipment development trials using CHPRC provided simulant based upon the results of the POP trials
- Equipment fabrication – Independent feeds
- New pumps/variable speed drive skids
- Testing at the MASF facility conducted by CHPRC with technical support from NVE team
- Trials extended to cover settler sludge as a second simulant

Prototypical Trials 2



Prototypical Trials 3

Prototypical Trials 4

Coanda head – Mobilization Flow

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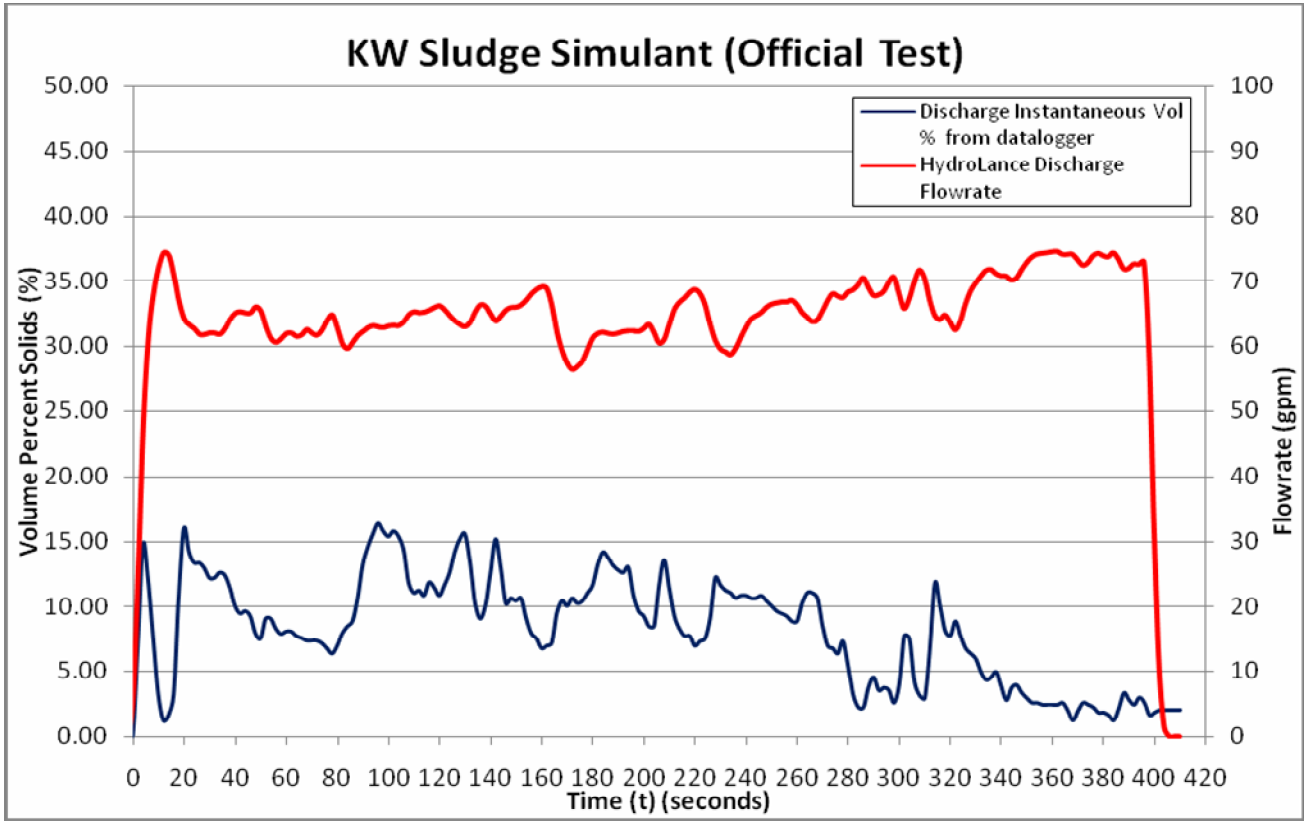
Prototypical Trials 5

Prototypical Trials 6

Prototypical Trials 7

Prototypical Trials 8



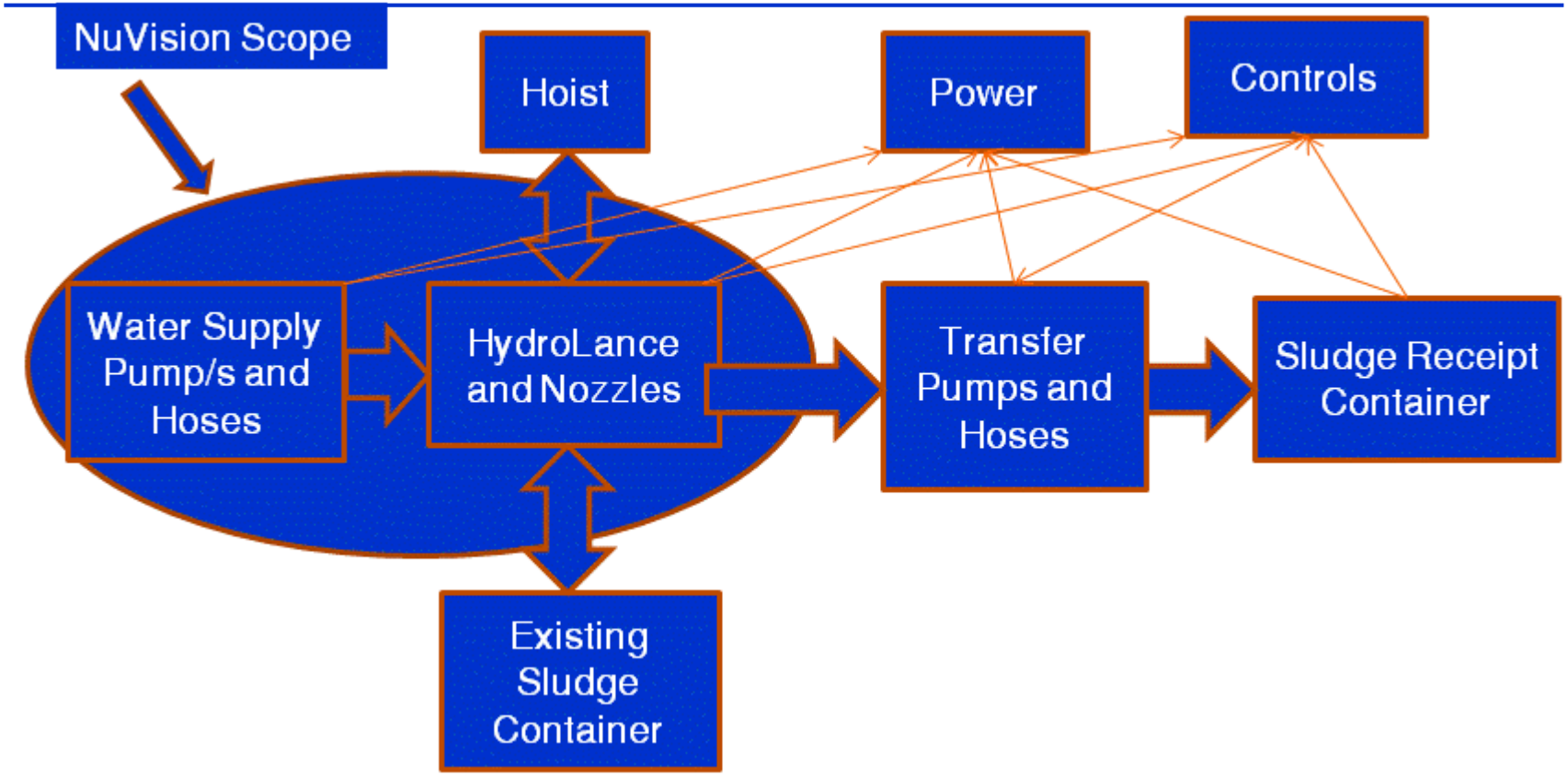
Prototypical Trials 9

- In the case of the system performance with container sludge simulant, the minimum volume percent criterion of 5 was successfully achieved. The average concentration achieved was 10.3 volume percent.

Prototypical Trials 10

- For the system performance with Settler Tank sludge simulant the target 5 average volume percent was 90% achieved.
- The narrow margin by which the target was missed and analysis of the concentration vs. time profile during the test indicates that the fluidization and retrieval concept utilized by the HydroLance is suitable for use with the Settler Sludge.
- The conclusion was that by optimizing the method of operation and integration of the HydroLance into an engineered retrieval system the target 5% can be met.

Future Work Overview



Future work – Program plan

- Support to TRL-3 testing
- On call technical support leading to CD1
- Conceptual design
- TRL-6 Testing
- Preliminary and final design
- Fabrication and FAT testing
- Operations

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Potential Applications

- Sludge retrieval from basins or tanks
  - Minimization of water addition
- Sludge mobilization and washing
  - Utilize the eductor to retrieve solids while washing solids in the mixer tube

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