



NOvA Operations Review Response to Questions

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Failure modes (1)

- > Have you performed a Failure Mode Analysis? Can you provide a list of failures that would significantly affect detector performance? Please comment on whether or not the resources required to address such failures in a timely manner have been identified (e.g. parts, people with requisite skill set).



Failure modes (2)

- Specific failure mode analyses have been carried out for some engineered parts.
- Example 1: Data Concentrator Module
 - Docdb 8323
 - Consequences were mostly “remove from run”
- Example 2: Brass hose fittings stress analysis and testing.
 - Docdb 9131
 - Consequence was replacement of fittings.



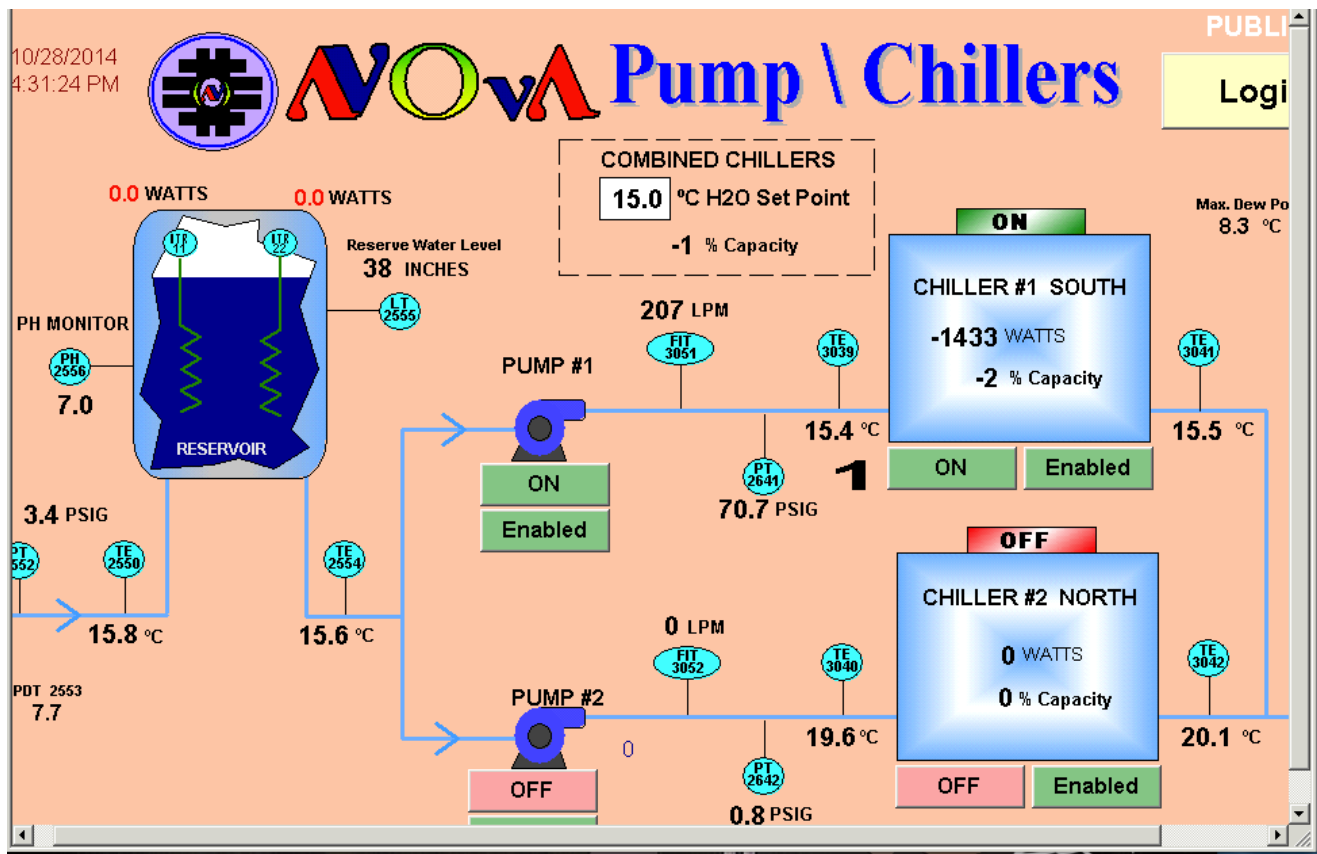
Failure modes (3)

- Other components and systems can cause downtime for the NOvA detectors
- Mechanical systems:
- Water cooling system
 - Mitigation – redundancy
 - System interlocked on reservoir level
- Dry air cooling system
 - Mitigation – redundancy
 - System interlocked on dew point of cooling air.



Failure modes (4)

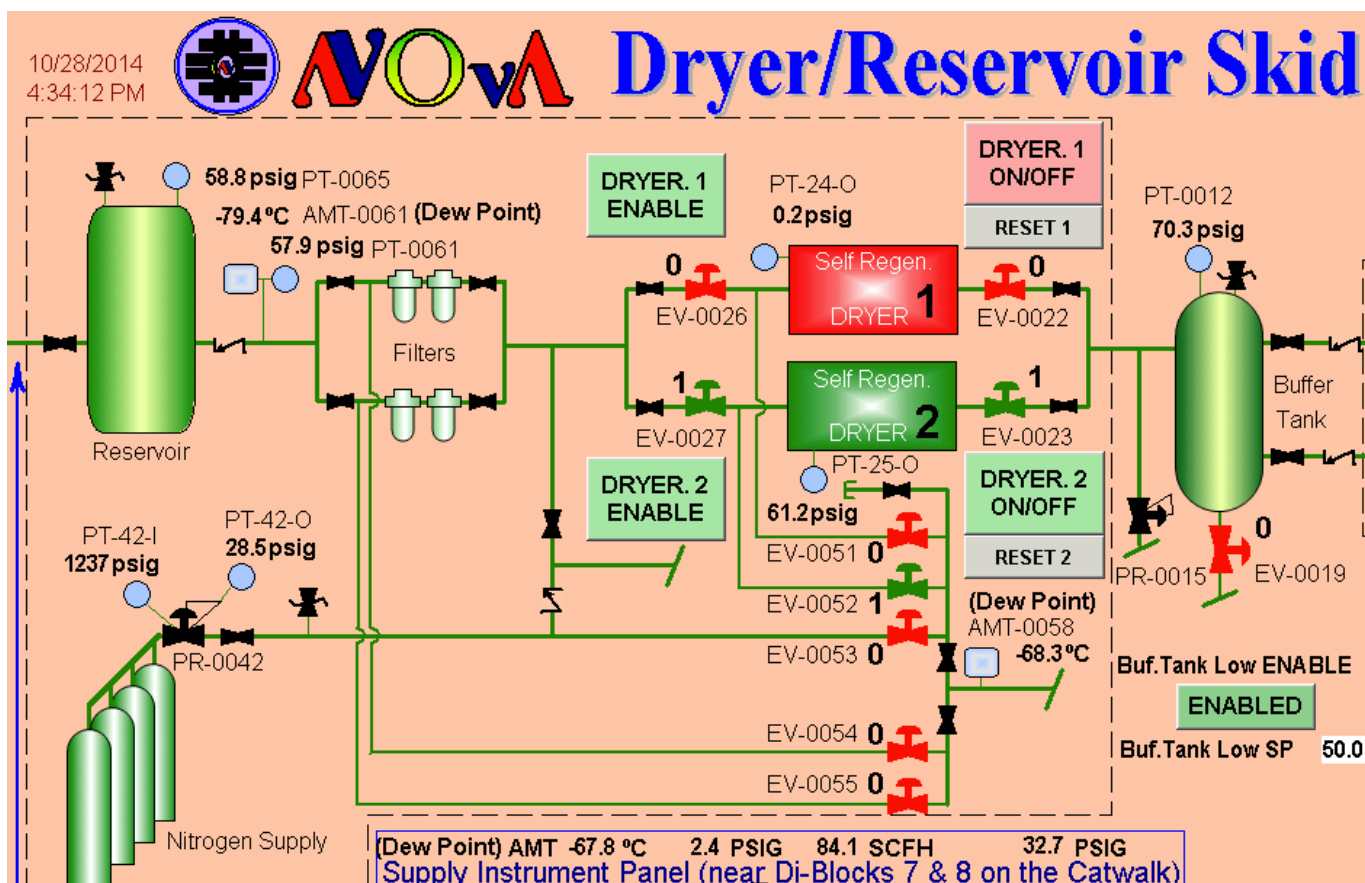
IFIX control system graphic of water cooling system, showing redundancies.





Failure modes (5)

IFIX control system graphic of air dehumidifier system, showing redundancies.



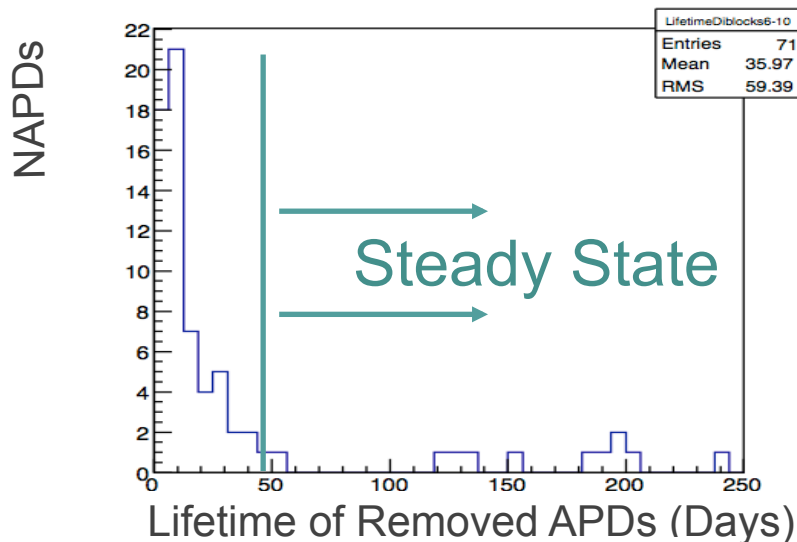


Failure Modes (6)

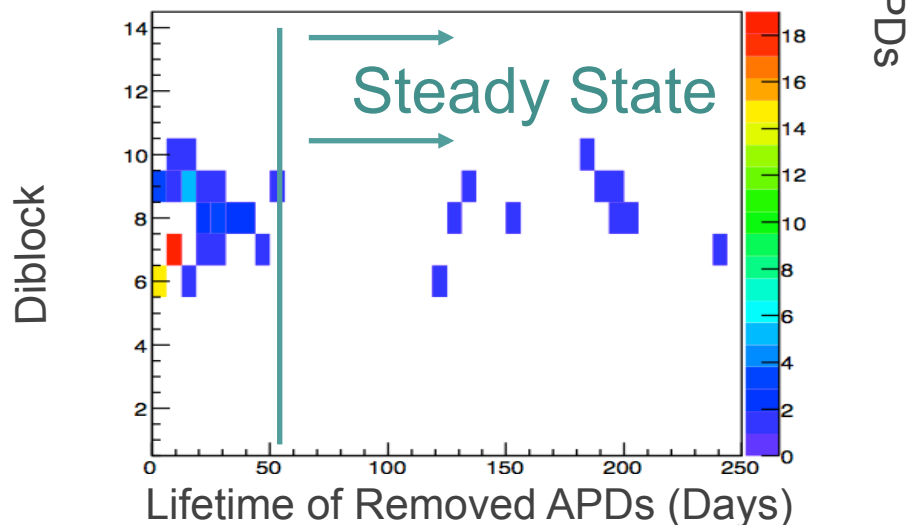
- Principal DAQ components
- Components
 - APD/TEC assembly
 - FEB's
 - TEC controllers (TECC's)
- Database records of replacements
- Large infant mortality background
 - On detector which was under construction
- Analysis underway



Failure Modes (7)



Rates not yet finalized, but seem consistent with 10 years of operations, possibly with some additional APD's (few hundred) either new or from removed stock of earlier type.



Similar analysis ongoing for FEB and TECC, which have significant spares.



Failure Modes (8)

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- Power supplies
 - Failures rare, little data.
 - Mitigation – additional spares, repairs
 - Commercial, with FNAL testing.
- High end DAQ components
 - DCM, TDU
 - Failures rare, little data.



Failure Modes (9)

- Resources for mechanical systems
 - Commercial systems
 - Cooling and drygas systems designed with Fermilab engineering, which will be used for consulting and followup.
 - Requires PPD/ND coordination by ND Technical Support Dept.



Failure Modes (10)

- Resources for principal DAQ systems
 - APD repairs to be done at Caltech
 - SOW to be finalized
 - At level of 25% FTE in first year
- Mechanical failures of heatsink bodies are some fraction of APD removals
 - Fermilab resources need to be identified for this, since Indiana construction SOW is completing.
 - Probably at 10-15% FTE level
- Analysis underway (Fermilab, Caltech) to firm up knowledge of failure rates.



Failure Modes (10)

- Resources for principal DAQ systems
 - FEB repairs mostly assembly and test of spares
 - SOW to be finalized with Harvard for approx. 15% FTE
 - Longer term, transfer to Fermilab resources; discussions with CS/RSE per TSW
 - On-board TECC controller board spares routinely mounted at Ash River.



Failure Modes (11)

- Resources for additional systems
 - DCM and TDU to be repaired by CS/RSE per TSW.
 - Power supplies commercial, shipping and testing by CS/RSE per TSW
 - Power distribution boxes (PDB's) to be repaired by U. Virginia. SOW draft to be finalized. Approx. one week/year (passive system).



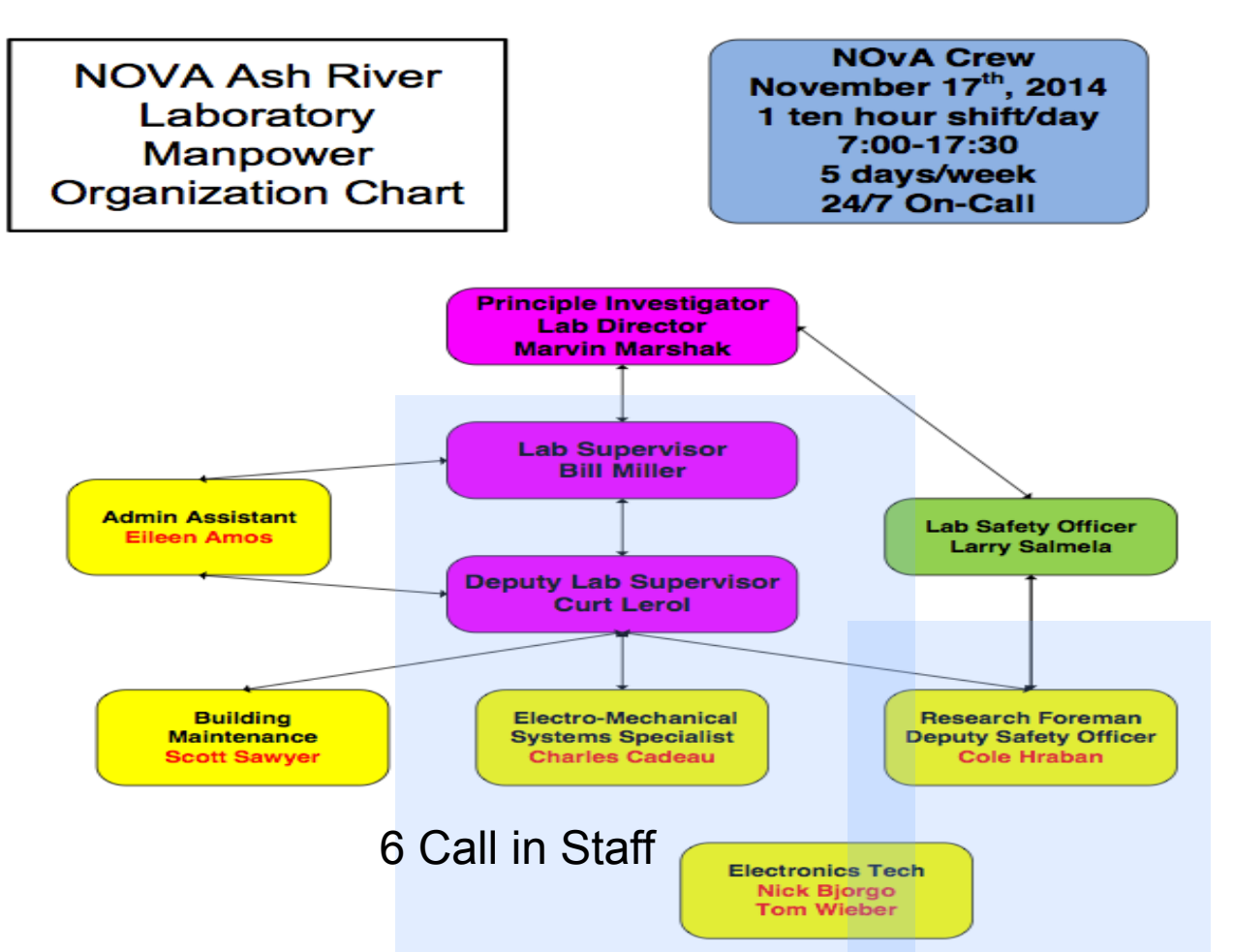
FD Budget and FTE Needs (1)

- > Can you please provide some additional justification for the budget requests provided in Rob's talk? for the FTE needs at the FD provided in Rob's talk?



FD Budget and FTE Needs (2)

- Ash River crew structure





FD Budget and FTE Needs (2)

- 6 Staff is minimum to maintain 24/7 call-in availability, with rotation, vacation, etc.
- Two-person rule requirement for working in NOvA building.
- Imprudent to reduce coverage at early phase of experiment.



FD Budget and FTE Needs (3)

Principal FY2015 BOE's

NOVA Far Detector Operations Basis of Estimate FY15 WBS 4.1 Crew Labor

WBS Name: 4.1. Crew Labor
Date of Estimate: 8/01/14
Estimate Generator: Bill Miller
Cost Category: Staff SWF
Costing Method: Wage Scale & OT estimate
Annual Cost: \$701,645
G&A Rate 26%: \$182,428
Total Loaded Cost: \$884,072

Description of Task: Provides Manpower for administration, supervision, and operations of the NOVA Far Detector building and NOVA Far Detector.

Wages are calculated from Oct. 1st 2014 till Sept. 30th 2015. The University of Minnesota SWF changes on July 1st of each year. There will be a 3% wage increase on July 1st 2014, the second year of the bi-annual contract. The fringe rate is 26.4% and the overhead rate remains at 26%. There is no approved contract for 2015/2016 so I will use 3% for the estimate starting July 1st 2016.

The estimated completion of the retro-fit for the replacement of APD's on the detector is not expected to be completed until late November to mid-December depending on availability of new APD's. I will use the reduction of staff from 9.85 FTE's to 7.6 FTE's to begin on FY15-Q2. The safety officer responsibilities will shift from Larry Salmela to Cole Hraban during this time periods as well.

On-Call costs are based on the AFSCME union rules of \$2/hour, average of 3 hours of OT/on-call event. In the last 11 months we have had approximately 60 on-call situations, 40 of them have been for water leaks and 8 for glycol heater in scintillator. I expect about 12 more water leaks, plus 12 for power outages/fire monitor calls or sump water issues in the spring. I have used 2/month for the cost estimate for an average of \$6.6K for wage and fringe. With five 10 hour work days we would have a total of 6256 hours on On-Call per person. Cost including fringe is \$34,233.

OT and differential pay is covered under WBS 4.1.6. I added 2% of the hours paid as OT and differential pay as needed to stay on schedule. If a 12 hour shift is worked or a non-standard a \$0.60/hour differential is paid. Also under WBS 4.1.6 I have added Sue Kasahara who is working 4 hours per week during the school year and 12 hours/week during the summer.

FY15	Description	Cost	Overhead	Total
4.1.1	Laboratory Supervisors	\$ 286,515	\$ 74,494	\$ 361,009
4.1.2	Administrative Assistant	\$ 30,318	\$ 7,883	\$ 38,201
4.1.3	Groundskeeper/Custodian	\$ 60,474	\$ 15,723	\$ 76,197
4.1.4	Electronics Foremen and Techs	\$ 197,580	\$ 51,371	\$ 248,951
4.1.5	Operation Tech	\$ 65,123	\$ 16,932	\$ 82,055
4.1.6	On-Call, Shift Diff, OT	\$ 57,941	\$ 15,065	\$ 73,005
4.1.7	Safety Officer	\$ 3,694	\$ 961	\$ 4,655
4.1	Crew Labor	\$ 701,645	\$ 182,428	\$ 884,072

Labor Needs

WBS Total \$884 K



FD Budget and FTE Needs (4) Principal FY2015 BOE's

NOVA Far Detector Operations Basis of Estimate FY15 WBS 4.2.1 Electrical

WBS Name: 4.2.1 Electrical
Date of Estimate: 8/13/14
Estimate Generator: Bill Miller
Cost Category: Utilities
Costing Method: Engineers estimate, Power company rates
Annual Cost: \$402,082
G&A Rate 26%: \$104,541
Total Loaded Cost: \$506,623

Description of Task: Provides electrical power for the NOVA Far Detector building, including operations of the NOVA detector.

Estimates were calculated by Fermilab & Burns and McDonnell in 2011 based on expected power loads. Detector construction started at least a year after it was expected. I estimated FY14 rate by 20% of the engineer estimate. Based on the first 10 months and estimating the final 2 months we are running 30% of the estimated total usage using only 2,503,000 kWh. In my original FY15 estimate I used a 20% reduction for FY15. I will increase the reduction to 30% of the engineer's power usage estimate which is still a 20% increase in power usage over FY14.

Engineer Estimates B&M estimate using North Star Rates			
	FY13	FY14	FY15
Estimated Usage	2,501,000 kWh	3,657,000 kWh	468,200 kWh
Fixed Rate	\$ 984	\$ 1,033	\$ 1,085
Demand/KW	\$ 72,939	\$ 88,356	\$ 105,117
Energy/kWh	\$ 220,088	\$ 329,130	\$ 468,200
Power Factor	61%	77%	87%
Total Annual Cost	\$ 294,011	\$ 418,520	\$ 574,403
U of M Overhead 26%	\$ 76,443	\$ 108,815	\$ 149,345
Operations Total	\$ 370,454	\$ 527,335	\$ 723,748
		\$ 334,816.07	\$ 402,082.12
		\$ 87,052.18	\$ 104,541.35
		\$ 421,868.25	\$ 506,623.47
		20% reduction	30% reduction

FY14 Total-August and September estimated				
Q1	Q2	Q3	Q4	Total
\$ 59,405.89	\$ 67,775.52	\$ 65,129.10	\$ 83,768.71	\$ 276,079.22
\$ 15,445.53	\$ 17,621.64	\$ 16,933.57	\$ 21,779.86	\$ 71,780.60
\$ 74,851.42	\$ 85,397.16	\$ 82,062.67	\$ 105,548.57	\$ 347,859.82
Total KWH				
526,080	612,000	589,440	776,240	2,503,760

Electrical Needs Building HVAC and Detector

WBS Total \$507 K



FD Budget and FTE Needs (5)

Principal FY2015 BOE's

NOVA Far Detector Operations Basis of Estimate FY15 WBS 4.3.5 Safety

WBS Name: 4.3.5.3 Safety Inspections/Contracts
Date of Estimate: 8/15/14
Estimate Generator: Bill Miller
Cost Category: Safety
Costing Method: Based on FY12-14 costs
Annual Cost: \$37,075
G&A Rate 26%: \$9,640
Total Loaded Cost: \$46,715

Description of Task: In FY12 we spent just \$14,929 for annual safety inspections since many of the items were still under warranty. In FY13 we spent \$24,707 and \$31,555 in FY14. This includes elevators, cranes, fire mist system, fire extinguishers, fire monitor, water testing, and MPCA permit. This does not include any maintenance for equipment (except for elevator) that needs repair since everything has been covered under the building construction contract up until now. Items highlighted in blue we have existing contracts in place. I have increased the FY15 cost by 10% to cover repairs and ES annual increase. FY15 \$37,075

- ThyssenKrupp Elevator- 5 year contract Apr 2013, \$400/month, annual increase 3% or CPI. 5 annual inspections. Full coverage equipment parts and labor. It is paid quarterly, cost in July 2014-\$1236.00
- Electric Scientific gives us an annual quote because the pricing on subs change. FY14 cost (attached document) was \$16,500. I also included the 2015 labor rates for any additional work. One service call in FY14-\$2807
- ~~WUResponse~~ Center has an annual fee of \$294/year
- Wayne Transport-3 year contract Feb 2011-\$500/year plus water charge/100 gallon. In 2014 it was \$720.
- Falls Fire and Safety-\$245/year plus repairs-FY16 added cost for static test
- Pace Analytical-\$267/quarter, no testing in Jan. \$803
- MPCA Permit- \$1230/annually

2014 Contracts and Expenses

Equipment	Company	Cost	Repair	Total Cost
Elevator Maint /Inspection	ThyssenKrupp	\$ 4,656	\$ -	\$ 4,656
Elevator Permits	State of Minnesota	\$ 200		\$ 200
Fire Mist System Contract	Electric Scientific	\$ 16,500	\$ 2,807	\$ 19,307
Fire Monitor Contract	WUResponse Center	\$ 294	\$ -	\$ 294
Fire Water Contract	Wayne Transport	\$ 6,720	\$ -	\$ 6,720
Fire Extinguishers Contract	Falls Fire & Safety	\$ 245	\$ 250	\$ 495
Water Testing-Contract	Pace Analytical	\$ 803	\$ -	\$ 803
MPCA Permit	Minnesota PCA	\$ 1,230	\$ -	\$ 1,230
Totals		\$ 30,648	\$ 3,057	\$ 33,705

Safety Requirements and Permitting

WBS Total \$34 K