



DOWNES ASSOCIATES INC

Engineering & Management Consultants

**Utilities Commission
City of New Smyrna Beach, Florida**

**Assessment of Existing Reciprocating
Electrical Generation Equipment
- Final Report -**

**Smith Street and Swoope
Generating Facilities
(Project No. 306.021)**

July 29, 2011

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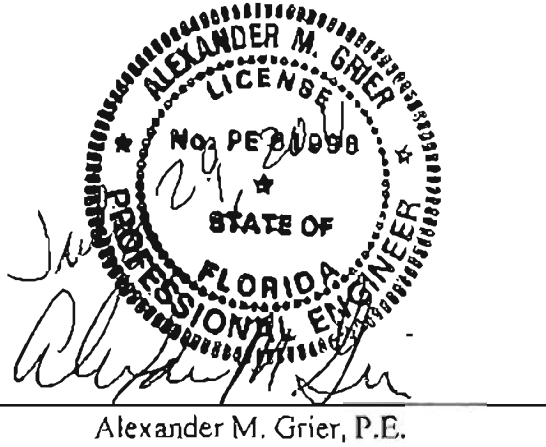
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CERTIFICATION

The technical material and data contained in these documents were prepared under the supervision and direction of the undersigned, whose seal as a Professional Engineer is affixed below.



Alexander M. Grier, P.E.

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Section 1

Executive Summary

In anticipation of new air emission compliance required upgrades (RICE NESHAP), the Utilities Commission, City of New Smyrna Beach (UCNSB) requested Downes Associates, Inc. (DAI) to conduct background equipment investigation and onsite assessment of the various engine-generator units and ancillary equipment. This equipment is located at the Smith Street and Swoope facilities, a total of eleven generating units in all. In addition to making an extended site visit, DAI staff reviewed the recent operating and maintenance history of each unit, interviewed the UCNSB maintenance staff, researched the availability of engine replacement parts and overhaul costs, and verified upgrades for engine controls and electrical gear. Based on this information, along with our previous experience with similar equipment at other clients, DAI prepared this assessment report complete with probable costs for replacement equipment and repairs necessary to return each unit to a state of readiness. Depending on the particular unit, it was determined that the average probable costs inclusive of all major repairs and equipment upgrades would be \$800,000 per unit, with a 25% contingency. Costs for the necessary repairs, renovations to the existing buildings, or a new power plant building altogether would be required. A new building is recommended.

If the entire fleet of engine generators were to be repaired and emission controls added to meet the RICE NESHAP air permit requirements, the repairs and replacements would total \$8.88M to \$11.1M with contingency. The repaired equipment should be replaced in a new building at a different site. The cost for site development, building, and electric interconnection is \$2M to \$4M. The repair, upgrade, and recovery of the 17,775 KW nameplate capacity is \$10.9M to \$15.1M. 18,000 KW of new liquid fueled turbines or high speed engine generators could be purchased and installed for \$12M to \$15M.

In the final analysis, due to the age and inefficiency of the engine-generator units along with the high capital costs to make the necessary repairs and upgrades, it was our determination from this study, with the possible exception of the Fairbanks-Morse Units #3 and #4 at the Swoope facility, each of the existing engine-generator units had effectively reached the end of its useful life for this utility. Essentially none of the units can be operated at this point in time without some repairs or replacement equipment needed. Though Units #3 and #4 at Swoope are the newest units and are perhaps still viable engines, it is our opinion at the conclusion of this assessment study that the capital required for repairs and component replacement may be better invested in a new facility complete with new fuel-efficient, high-output engines capable of supplying reliable power generation for many years to come.

If these units are abandoned and decommissioned, UCNSB will need to replace the loss of the existing nameplate capacity of 17,775 KW. The capacity may be purchased from others at \$12 to \$13/KW-month or replaced with new generating equipment to maintain local generation for hedge and emergency.

Section 2

Background

Downes Associates, Inc. (DAI) was asked by the Utilities Commission, City of New Smyrna Beach (UCNSB) to conduct an equipment and site assessment at two of their existing power plants: Smith Street and Swoope. Both of these facilities have various makes of older reciprocating diesel engines, some of which have not been operated for perhaps several years. Prior to making a decision to decommission some or all of these units, or to invest capital to bring them into compliance with the new US EPA RICE NESHAP regulations, it was decided that an independent objective evaluation should be made in order to state more definitively the condition of each unit and if necessary, the main tasks required to restore the units to operation along with the associated probable costs.

In 2006, as part of an overall study of the City of New Smyrna Beach electrical utility, RW Beck had included a cursory evaluation of the generating equipment. At that time, they identified some engines that were in need of repair and made some general statements as to the overall condition of the buildings and equipment. In addition, they cited some concerns as to the availability of spare parts for some of the engines and the risks to these two plants caused by hurricane storm surges.

On March 3, 2011, DAI made an initial visit to the two facilities to gather some preliminary information and take some photos. This information was evaluated and a preliminary report was issued to UCNSB prior to the main assessment visit. What follows is our report on the main assessment visit and subsequent investigation.

Section 3

General Power Plant Assessment – Smith Street & Swoope Facilities

On April 5, 2011, DAI personnel visited the UCNSB Smith Street facility to conduct a first-hand inspection of the engine-generator units, the associated equipment, and electrical gear at this site. A similar visit to the Swoope facility was made on the following day. We were accompanied by two UCNSB maintenance and operation personnel, Richard Rahl and Todd Ruggles, throughout our visit.

Smith Street: The Smith Street facility is situated on city-owned property located approximately one block south of the community's Bert Fish Medical Center. The facility itself consists of a single main building of older construction with a largely open floor plan. The building houses five engine-generator units totaling approximately 6.54 MW along with the associated electrical switchgear, some personnel offices, and plant storage areas. The engines are fueled from a 15,000 gallon No. 2 fuel oil storage tank also onsite. In addition, there are three peaking engine-generator units located in self-contained enclosures at the opposite corner of this property. Each of these units is a General Motors Electromotive Division (EMD), 2.0 MW nameplate rating (6.0 MW total), fueled from an 18,000 gallon No. 2 fuel oil storage tank.

The main power plant building at this location is in disrepair and inadequate to protect the power plant equipment. Although the determination of the actual condition of this building is beyond the scope of this report, we learned of various issues affecting the main building including nonfunctional overhead lighting, infestation of termites, and a partial roof collapse over one of the parts storage areas along with other roof leaks. There is no apparent forced building ventilation, so the building is kept open for most of the working day. As a result, no protection is afforded to equipment that may be sensitive or prone to deterioration or damage from high humidity, salt air, and/or dust. Also, as was written in the RW Beck report, this facility and the equipment it contains are susceptible to flooding by the storm surge from a Category 5 hurricane.

Once inside the power plant building, we found conditions indicative of a plant that has not been in operation for an extended period of time. There were collections of various maintenance items stored around many of the engines. Housekeeping was minimal. This building is currently being used as a maintenance shop. This is completely understandable given the condition of the generating units.

Swoope: The Swoope power plant is located on property also owned by the City of New Smyrna Beach and situated adjacent to the Intracoastal Waterway, near to both the Atlantic Coast and the New Smyrna Beach Airport. Because of the close proximity to the coast, this property resides within an area that is susceptible to flooding by the storm surge from a Category 1 hurricane.

Swoope currently houses three (3) Fairbanks-Morse engine-generator units with a nameplate output totaling 5.145 MW. The units are diesel powered and are fueled from an 18,000 gallon No. 2 fuel oil storage tank on site.

The power plant building at Swoope remains in fair condition despite the weathering and corrosion caused by its close proximity to the ocean. It is basically a steel shell with two bays inside where the engines are located, a small personnel office, and some storage. The main part of the building houses the two larger engines and all of the electrical switchgear; the smaller engine is located in a wing off from the

main part of the building. The building is open-air ventilated, with no indication of major leaks or other defects other than the partial breakdown of the insulation on the inside ceiling. Housekeeping seemed sufficient for a facility of this type. All areas around the engines were clear.

General Notes and Comments: In the discussion that follows, we have attempted to describe the condition of each engine-generator unit along with its associated ancillary equipment. A number of pictures have been included to try to indicate a deficiency or the general condition of each unit or equipment component. In addition, we have included some probable costs for repair or replacement of equipment items as necessary. These costs are based on preliminary budgetary estimates received from experienced vendors or our recent experiences working with similar needs from other clients. Should UCNSB elect to move forward with any subsequent repairs or equipment replacement, it is important to note that vendors for replacement equipment and/or repairs will need to be brought onsite to determine the needs first-hand before a more refined cost can be determined.

One general area of concern is the condition of the electrical panels and switchgear needed to deliver the electric power. In their report from 2006, RW Beck indicated that because of the age of this equipment located at the Smith Street facility, it may “require replacement or at the very least checking and calibration.” It is our informed opinion that any attempt to maintain safe and reliable operation in the future requires the entire lot of this equipment to be replaced. A similar statement could be made regarding the electrical equipment at Swoope, though it appears to be in better operating condition overall. The existing panels and electrical gear are vintage 1950-1960, and are the open-console type

typical of that era. Certainly, this equipment suffers from the effects of insulation deterioration and corrosion due to years of exposure to the moist, humid, and salty atmosphere. We have had the opportunity to work with a number of clients that had equipment of similar age and condition. The likelihood of periodic component failures is high. In fact, this has already occurred as evidenced by the carbon deposits shown in the adjacent photo.



DAI has concern that the continued operation of this type of equipment may present some potential hazards to UCNSB personnel during its use. These panels are not a current design which affords operators protection from arc flash. The existing UCNSB gear can be dangerous and present potentially greater and greater hazards the longer it remains available for use. Because both buildings are completely open, the panels and switchgear are exposed to temperature changes, high humidity, dust, and possible infestation of vermin. These conditions are not conducive to the safe, reliable, and extended operation of this type of equipment.

Modern, new metal-clad switchgear, panels, relays, and controls can be purchased and installed for any of the engine generators. It is costly, but it would offer the protection safeguards, reliable operation, and functionality needed for an operating utility. In our evaluation of each engine, budgetary costs for new replacement electrical gear have been included. However, it should be noted that this equipment must be

installed in a temperature and humidity controlled room, not in an open facility as it is now. To do otherwise would be ill-advised.

We have also elected to include budgetary costs for basic replacement engine controls for each unit. These new controls would be fully electronic, replacing the existing electromechanical controls original on each unit, and would include basic features such as alarms, shutdowns, bearing protection, air-fuel controls, etc, but still require the engine to be started and operated in a manual mode. A much more advanced and automated engine control system is also available, but at a considerable cost, perhaps as much as three times that of a standard package. In either case, new engine controls would be important for the continued safe operation of the engines and to protect the overall investment in each unit.

In this report, we have documented the existing condition of the installed equipment at the two power plants and outlined the probable costs that would be involved to return the engine-generator units to a state of reliable operation for years to come. Because of the condition and age of this equipment, these costs are not insignificant. In addition, we must consider the fact that the existing buildings are not suitable to house updated equipment, so the costs associated with the construction of a new power plant building and the relocation of the engines should also be considered. A conceptual level estimate of those costs has been included near the end of this report. At this time, we do not believe that any of these are prudent investments on the part of UCNSB, but have presented them as due diligence in this study and to aid the overall decision-making process for this utility.

Special Note: To anyone reading this overall facility and equipment assessment report, it might be easy to try to somehow place blame or find fault with the maintenance staff for the existing conditions and general lack of readiness of much of the equipment. However, we would like to stress that in our opinion, to do so would be in error. During our three day visit which included stops at each of the three power plants owned by UCNSB, we found both Mr. Rahl and Mr. Ruggles to be very knowledgeable and also very concerned about the condition of these facilities. They both find themselves in the difficult position of having to try to get the greatest amount of functionality possible from equipment for which repair and/or replacement is simply long overdue. No doubt, for the past several years they have been called upon to try to extend the service life for some pieces of equipment that should have been replaced already. They have likely ‘answered the call’ many times in the past several years to carefully bring some piece of equipment online in spite of its condition. It takes genuine talent and skill to do this, and we see these two gentlemen as important resources and assets for this utility. They should be commended for their efforts, loyalty, dedication, and service to this utility.

Section 4

Smith Street Facility: Engine-Generator Units & Ancillary Equipment

Unit # 3: Fairbanks-Morse Model 33F16

S/N: 8804064

Date of Manufacture: ca. 1940

Date of Installation: 1946

Fuel: No. 2 Fuel Oil (Diesel)

Facility Heat Rate: 12,300 Btu/kWh

Governor: Woodward Type 1C

Nameplate Electrical Output: 840 kWe

Generator Output Voltage: 4160V

Date of Last Operation: Prior to C/Y 2006

Description: Older model Fairbanks- Morse engine, 6 cylinder, non O-P, non turbo unit. Engine nameplate indicates 1200 HP rating at 300 RPM. Unit was reportedly operated approximately three years ago, but records indicate no significant run-time since sometime prior to 2006. UCNSB maintenance staff characterized this engine as “a little weak” in output, likely indicative of some degree of wear in the piston rings not unexpected for an engine of this vintage. The overall engine appears sound with all components seemingly in place and functioning. There is a considerable amount of dust and dirt on the valve covers on top of the engine and also some rusted areas which may be due to possible leaks in the roof overhead. The condition of the generator for this unit is reported to be good, but it should be cleaned and tested prior to returning the unit to service.

Discussion: Though this engine appears sound, short of performing some engine diagnostic testing, there is no way to determine the condition of the engine internally. Though the engine is rated at 840 kWe, it seems the engine is no longer able to generate the rated power. We suspect some blow-by within one or perhaps all of the cylinders causing a reduction in the engine output as compared to the rating. Also, given the report that the engine has not been turned over in at least three years, the condition of the main bearings may be suspect. But regardless, given the age of the unit and no indication of any recent rebuilds, if this unit was needed for a significant amount of generation in the future or to be depended on for reliability, an overhaul is prescribed.

From our investigation, we have learned that Fairbanks-Morse sold the support of their older, out-of-production, non opposing-piston engines to W.W. Williams, Inc. in Akron, OH. This company was recently contacted by DAI to determine the general availability of replacement parts for the 33F16 engine. We found this company to be generally responsive to our phone and internet requests. Though it is unlikely that they would have replacement parts in stock for this engine, we were told they have all the drawings for the parts for this engine model, and with the exception of component castings, can upon request make whatever parts are typically required. They can also provide a reprinted parts catalog for this engine and possibly maintenance manuals.

The cooling unit for this engine (shown in photo) which is located near the main overhead door on the side of the building opposite all other cooling units, generally seems to be in usable condition. No indication of the age, but it seemed to be in better condition than the cooling units for the remaining four engines in this building. It does not show the obvious signs of corrosion and perforations in the outer panels as is apparent on other cooling units at this site. But since this engine has not operated for a number of years, some amount of maintenance and repairs can and should be expected before restarting.



The exhaust silencer for Engine #3 (shown in the center of the adjacent photo) is a flange-mounted unit, fed from a pipe located below the power plant floor elevation. This unit is unique in this feature. The lower flange where the base of the silencer is mounted is located on a small concrete pad along the exterior of the power plant building wall.

The condition of the exhaust silencer unit for this engine is thought to be typical of the other units located at this facility. Though the main body of the unit has been repainted in recent years, through age and lack of use, it has likely succumbed to the deterioration and corrosion caused by the constant exposure to the moist, salty atmosphere. A few significant areas of rust were apparent, especially near the base of the unit. Surface ripples or an otherwise non-smooth appearance of the outer shell of the main body of an exhaust silencer is an indicator of the weakening of the unit attributable to inner corrosion. Observations indicate this condition is evident here.



From the standpoint of the engine and the ancillary equipment, one could estimate the following costs to return this engine to a condition where it would be expected to provide consistent, reliable service on an as-needed basis:

- a. Engine overhaul including cylinder liners, rings, bearings, seals, rebuild injectors, pumps, replace valves, other typical machining work, etc: \$280,000
- b. Updated engine controls: \$160,000
- c. Updated electrical switchgear & relays: \$180,000
- d. Generator test: \$20,000

- e. Replacement exhaust silencer with catalyst to comply with RICE NESHAP, installation, and testing: \$60,000
- f. CPMS monitoring equipment: \$5,000
- g. Engineering: \$60,000
- h. Other miscellaneous: \$35,000

Total: \$800,000

Remarks: Though this engine may be a good candidate for an overhaul due to its current condition, we cannot ignore the fact that it is still a 60-plus year old engine. Even at its best, it can only produce 840 kWe output while consuming fuel at a relatively high rate compared to the much more efficient engines being manufactured today. Given the circumstances, it seems that the money to be spent in repairs and upgrades to this very fine old engine would not be worthwhile. It is our determination that this engine is essentially at the end of its useful service life in this facility.

Unit # 4: Superior Model 80 EX8

S/N: 12957

Date of Manufacture: ca. 1940

Date of Installation: 1950

Facility Heat Rate: 12,300 Btu/kWh

Fuel: No. 2 Fuel Oil (Diesel)

Governor: Woodward Type UG8

Nameplate Electrical Output: 1000 kWe

Generator Output Voltage: 4160V

Date of Last Operation: Prior to C/Y 2006

Description: Engine manufactured by Superior, 8 cylinder model with turbo, 1440 Bhp at 360 RPM per nameplate data. UCNSB maintenance staff claims this engine will operate but has become ‘weak’ over the years, a condition indicative of cylinder blow-by due to wear and/or poor injector operation. Though it has a rating of 1000 kWe, we suspect it is only capable of something considerably less. Unfortunately, it has not been started and run for at least five years. Overall engine appears sound with all components seemingly in place and functioning. Condition of the generator for this unit is reported to be good, but it should be cleaned and tested prior to extended service.

Discussion: Without the benefit of any engine diagnostic tests, we can only speculate as the internal condition of this engine and its components. However, this particular engine has valve cover panels that are easily removed, providing access to the rocker arms, injectors, cam followers, and the individual engine heads. Engine oil is pumped into this part of the engine at high volume and very low pressure to essentially flood these components with lubricant during operation. During our visit, UCNSB maintenance staff removed some of these access panels. There was no evidence of any sludge, or apparent excessive component wear (see photo insert); overall this area was extremely clean. It seems this engine was well maintained during its years of operation.



From our research, we learned that Superior engines are now supported by Cameron Compression Systems in Houston, TX. We have contacted them directly and confirmed this fact. This company has acknowledged providing replacement parts and repair services for the Superior Engines, but they also indicate that the Model 80 engine is about the oldest engine in that line that they can support. Because of its age, the delivery of replacement parts is typically longer than usual, but they state they have all the parts patterns and drawings to produce generally whatever is required to return an engine of this make and model to service. Typical replacement parts listed included rings, bearings, pistons, cylinder liners, connecting rods, and even a crankshaft if necessary.

According to the maintenance staff at UCNSB, the particular cooling unit for Engine #4 is apparently not in working condition. (Photos of this unit are shown below.) Though the outside panels appear largely intact, (some rust and peeling paint), the inner parts are apparently corroded to the point where the unit can no longer properly function. Observations while on site seem to support this assessment. Without a functioning cooling unit, this engine cannot be started and run at all, regardless of the condition of the engine itself.



The reported condition of the exhaust silencer is also poor. As can be seen in the photo, this unit rests on an elevated concrete base with a high inlet pipe. The unit shows evidence of significant rust and possible perforations at the bottom section. Given the fact this engine has not run for several years, there is nothing to prevent water from settling in the bottom of the silencer unit and corroding the base and inner components. As was the case for the cooling unit, the condition of this component itself would prevent this engine from being operated safely and effectively. With a non-functioning cooling unit and a rusted silencer with possible perforations, it is completely understandable why this unit has not been started and run in several years. To start this unit under these conditions would be ill-advised.



Associated with this engine is also a unique external air intake unit. This is also shown in the photo. The condition of this unit is somewhat questionable given the overall appearance. The simplicity of the unit should allow it to continue to function, but its outward appearance gives further evidence of a need for replacement and/or upgraded components should this engine need to operate in the future.

The following represents a probable cost estimate for the required repairs and/or replacement of major equipment items necessary for this unit to provide consistent, reliable service:

a. Engine overhaul including cylinder liners, rings, bearings, seals, rebuild injectors, pumps, replace valves, other typical machining work, etc:	\$380,000
b. Updated engine controls:	\$160,000
c. Updated electrical switchgear & relays:	\$180,000
d. Generator test:	\$20,000
e. Replacement cooling unit:	\$45,000
f. Replacement exhaust silencer with catalyst to comply with RICE NESHAP, installation, and testing:	\$80,000
g. CPMS monitoring equipment:	\$5,000
h. Engineering:	\$65,000
i. Other miscellaneous:	<u>\$45,000</u>
Total:	\$980,000

Remarks: This engine is also probably a very good candidate for a successful major overhaul given its overall condition and the perceived availability of replacement parts. But as with other units at this plant, it is still a 60-plus year old engine providing only 1000 kWe of electric power. It is our determination that this engine is at or at least very near the end of its useful service life in this setting, and not worthy of UCNSB making this kind of capital investment.

Unit # 6: Enterprise Model DSR38

S/N: 55039

Date of Manufacture: 1955

Date of Installation: 1955

Facility Heat Rate: 12,300 Btu/kWh

Fuel: No. 2 Fuel Oil (Diesel)

Governor: Woodward Type UG-32

Nameplate Electrical Output: 1800 kWe

Generator Output Voltage: 4160V

Date of Last Operation: C/Y 2006

Description: Engine manufactured by Enterprise Engine, a company owned by Transamerica Corporation during the time this unit was built. The Enterprise division was later sold to Cooper Industries and remains part of that group today. This unit is an 8 cylinder model with turbo, 2532 Bhp at 360 RPM per nameplate data. UCNSB maintenance staff claims this engine was last started sometime early 2010 and runs well, though operating records indicate no significant amount of run time for since calendar year 2006. Overall this engine appears sound with all components seemingly in place and functioning. There are perhaps some minor leaks around the engine heads and at various places at or near the fuel injectors and delivery apparatus. These types of leaks are typical of an engine that is running and not necessarily indicative of a need for any major repairs. There was some noticeable rust around some of the head bolts, but this is probably due to minor roof leaks from overhead. The condition of the generator for this unit is reported to be good, but it should be cleaned and tested prior to service.

Discussion: This engine-generator unit appears to be in fair condition overall. But since no diagnostic tests are available, nor was this engine run during our visit, any statements on the internal condition and/or readiness of this engine must be qualified. And that is certainly the case here. However, from our understanding of the reports received from UCNSB personnel and our onsite observations, this engine is most likely able to run and produce power with minimal and/or reasonable amount of preparation.

As was the case for the Superior engine, we have confirmed that the Enterprise engines are also supported by Cameron Compression Systems in Houston, TX. Apparently, the Enterprise engines were very popular in the power generation business and a number of them are still used today. Because of this popularity, it seems that replacement parts are more readily available for these

engines than for some others. Should the need arise for a part for this engine, we are reasonably confident that Cameron could supply it.



However, the ancillary equipment needed to run this unit safely and effectively is definitely not in a state of readiness. The cooling unit for this engine is reported to be in very bad condition, suffering from the effects of considerable internal corrosion. This particular one is a Marley brand cooling unit and is shown in the adjacent photo. Similar to other units at this site, it still looks intact externally, but the base water collection areas as well as some of the upper components indicate a condition of severe

rust buildup. This condition would prohibit an effective and sufficient circulation of the cooling water to and from the engine during operation.

In a similar manner, it seems the exhaust silencer for this engine also suffers from a significant amount of rust and deterioration. In particular, the inlet pipe and elbow that extend into the lower part of the silencer unit exhibit severe corrosion. The platform and support stand surrounding the unit are extremely rusted, and the tail pipe that normally extends from the top of the unit is missing completely. UCNSB maintenance staff report this silencer to be in very poor condition. No doubt, the internal condition of this unit has been severely compromised due to the presence of rainwater and moisture for long periods of time.



As a result, though the engine itself may be able to be run, its operation cannot be supported due to the condition of the other required equipment. The net result at this time is an engine that is out of service for all intents and purposes until and unless these two main components have been replaced. It would seem that though Engine #6 may have been run briefly about one year ago, it was probably quickly shut down as the problems and deficiencies with the supporting equipment became quickly apparent.

The following represents a probable cost estimate for the required repairs and/or replacement of major equipment items necessary to return this engine to a condition where it would be expected to provide consistent, reliable service on an as-needed basis:

a. Updated engine controls:	\$160,000
b. Updated electrical switchgear & relays:	\$180,000
c. Generator test:	\$20,000
d. Replacement cooling unit:	\$75,000
e. Replacement exhaust silencer with catalyst to comply with RICE NESHAP, installation, and testing:	\$90,000
f. CPMS monitoring equipment:	\$5,000
g. Engineering:	\$50,000
h. Other miscellaneous:	<u>\$45,000</u>
Total:	\$625,000

Remarks: Though Engine #6 is probably in running condition, the costs associated with the required replacement ancillary equipment are still quite significant. Though this unit is larger than some of the others considered thus far, at 1800 kWe output, it is still quite small as compared to the newer, much more fuel-efficient engines available today. Given the age of this engine and its inefficiencies along with the amount of capital investment necessary to replace deteriorated equipment, it is our determination that engine has also effectively reached the end of its useful service life at this facility.

Unit # 7: Enterprise Model DSR38

S/N: 55038

Date of Manufacture: 1955

Date of Installation: 1955

Facility Heat Rate: 12,300 Btu/kWh

Fuel: No. 2 Fuel Oil (Diesel)

Governor: Woodward Type UG-32

Nameplate Electrical Output: 1800 kWe

Generator Output Voltage: 4160V

Date of Last Operation: Prior to C/Y 2006



Description: Engine manufactured by Enterprise Engine, a company owned by Transamerica Corporation during the time this unit was built. The Enterprise division was later sold to Cooper Industries and remains part of that group today. This unit is an 8 cylinder model with turbo, 2532 Bhp at 360 RPM per nameplate data. UCNSB maintenance staff reports this engine underwent a major rebuild in late 1970s to early 1980s timeframe. The cost associated with that overhaul was approximately \$250k. Unfortunately, the generator is not in good operating condition and needs to be rewound, (again according to UCNSB maintenance staff). As a result, though this engine may be in good condition mechanically, operating records indicate no significant amount of run time for at least

the previous five years, perhaps much longer. The cylinder heads and valve covers are coated with a considerable amount of dust and a noticeable amount of what appeared to be mouse droppings. It is clear this engine has not been run for some time.

Discussion: As a result of the extensive repair work on this engine several years ago, Engine #7 may be in the best condition mechanically of any of the engines at this facility. It has probably not experienced a significant amount of runtime since being rebuilt. We would expect this engine to have an output at or near its nameplate capacity. No indication otherwise was expressed or perceived during our recent visit.

But as was the case for the other Enterprise engine, the condition of the ancillary equipment in place for Engine #7 would essentially prohibit the operation of this engine even if the attached generator was in good working condition. The cooling unit for this engine is reportedly in very poor condition, highly corroded and rusted internally from decades of exposure to water and the coastal environment (Photos of this Marley brand cooling unit are shown below). The unit also exhibits the effects of lack of use for a lengthy period of time with vegetation growth evident at one end of the tower air inlet.



Likewise the exhaust silencer for Engine #7 exhibits the effects of long-term exposure to the salty, moist environment. Apparently, it was painted some time ago, but the rust on the outer shell has bled through the coating of paint. Though this rust may be severe, it is not the essential problem. According to UCNSB maintenance personnel, the inside of this silencer is full of rust debris. We did not see any perforations in the outer shell, but have little reason to doubt their assessment. Also, as was the case for the adjacent Enterprise engine, the tower and stand for this exhaust silencer are heavily corroded as a result of years of exposure.

With this engine being out of service for a number of years, the passage of time has taken its toll on the accompanying cooling unit and exhaust silencer, to the extent that these units are no longer operational or serviceable. Though the engine itself may be in quite good condition, the unit altogether is essentially out of service and inoperable.

The following represents a probable cost estimate for the required repairs and/or replacement of major equipment items necessary to return this engine to a condition where it would be expected to provide consistent, reliable service on an as-needed basis:

a. Generator rewind:	\$175,000
b. Updated engine controls:	\$160,000
c. Updated electrical switchgear & relays:	\$180,000
d. Replacement cooling unit:	\$75,000
e. Replacement exhaust silencer with catalyst to comply with RICE NESHAP, installation, and testing:	\$90,000
f. CPMS monitoring equipment:	\$5,000
g. Engineering:	\$60,000
h. Other miscellaneous:	<u>\$30,000</u>
Total:	\$775,000

Remarks: Though this engine may be in the best condition overall of any of the engines at this facility, the costs associated with repairing and replacing the necessary ancillary equipment are prohibitive for an engine of this size and vintage. At 1800 kWe output, it is still quite small as compared to the newer, much more fuel-efficient engines available today. Given the age of this engine and its inefficiencies along with the amount of capital investment necessary to return it to proper operation, it is our determination that engine has also effectively reached the end of its useful service life at this facility.

Unit # 8: GM Cleveland Model 16-278A

S/N: 10150511

Date of Manufacture: ca. 1955

Date of Installation: 1961

Facility Heat Rate: 12,300 Btu/kWh

Fuel: No. 2 Fuel Oil (Diesel)

Governor: Marquette B135

Nameplate Electrical Output: 1100 kWe

Generator Output Voltage: 4160V

Date of Last Operation: Prior to C/Y 2006

Description: This particular model engine was manufactured by the Cleveland Diesel division of GM during a time period extending from the early years of WWII through the late 1950s. Though no

nameplate could be found on this engine, given the date of installation, this unit was probably among the engines produced during the latter years of production. This unit is a 16 cylinder model with blower, approx. 1600 Bhp at 720 RPM. UCNSB maintenance staff claims this engine is in running condition, though the operating records indicate no significant amount of run time for at least the previous five years. Overall this engine appears sound with all components seemingly in place and functioning. There are perhaps some minor leaks around the engine heads and at various places at or near the fuel injectors and delivery apparatus. These types of leaks are typical of an engine that has been running and not necessarily indicative of a need for any types of major repairs. The condition of the generator for this unit is reported to be good. The generator warmer on this unit was quite active, maintaining a noticeably higher temperature than on any of the other units at this facility. While this is good practice, the generator should be cleaned and tested prior to extensive operation.

Discussion: Without additional reports, a test run, or some engine diagnostics, it is not possible to state with any certainty the actual condition of this engine. From external appearances, it seems intact. Currently, there is a lot of clutter on both sides, indicative of a unit that has not been run for many years. As a result of this extended period of inactivity, any serious intentions on the part of UCNSB of returning this engine to more regular service should be preceded by some engine diagnostics and possibly an overhaul.

The future availability of replacement parts for this engine is a point of major concern. We could only locate one possible vendor, Applied Energy Corporation in Colorado Springs, which advertises support and replacement parts for the Cleveland Diesel units. However, their inventory of parts was very limited. In a subsequent phone conversation, we learned that they have a varying but ongoing supply of used components and some new replacement wear parts. Production of these engines was discontinued by GM at or near the time this particular unit may have been built, mainly due to the fact that GM also owned the Electro-Motive Company which became EMD. The EMD engines were more popular and were of similar size as the Cleveland engines, and as a result became the more prominent engine at that time. Because of this greater popularity and more widespread use, the EMDs are still well supported today while the Cleveland Diesel units seemingly not as much.

This engine is presently equipped with a radiator cooling unit (shown in the following photos) that is reported to be in poor condition. Outwardly, the condition is marginal; on the inside and underneath it is quite rusted. UCNSB staff reported engine overheating requiring shutdown during the last run, (and that may have been several years ago). It seems clear that this unit too has succumbed to the combined effects of age and exposure.



Outwardly, the exhaust silencer for this engine appears to be in good condition. It does not show the obvious signs of surface rust and heavy corrosion apparent on some of the other units. The base, the supports, and connections seem to be well intact. UCNSB staff report the condition of this unit as “unknown”, but suspect. This is likely due to the fact that this engine has not been run for an extended period of time and the high probability of internal rust debris buildup along with the corrosion of internal components. As this unit is located well above ground elevation with no stand or laddered access, it was not possible to make a close visual evaluation during our visit.

The following represents a probable cost estimate for the required repairs and/or replacement of major equipment items necessary to return this engine to a condition where it would be expected to provide consistent, reliable service on an as-needed basis:

a. Engine repairs and possible overhaul: (if replacement parts can be found!)	\$450,000
b. Updated engine controls:	\$160,000
c. Updated electrical switchgear & relays:	\$180,000
d. Generator test:	\$20,000
e. Replacement cooling unit:	\$45,000
f. Replacement exhaust silencer with catalyst to comply with RICE NESHAP, installation, and testing:	\$80,000
g. CPMS monitoring equipment:	\$5,000
h. Engineering:	\$60,000
i. Other miscellaneous:	<u>\$45,000</u>
Total:	\$1,045,000

Remarks: For the reasons stated above, the evaluation and assessment of this engine is offered with the greatest uncertainty as compared to the other units located at this facility. It seems intact and may indeed be in good running condition, but the reports obtained along with any visual evidence are insufficient to draw any firm conclusions. Without evidence of any previous engine overhaul activity, and presuming this engine has seen a significant amount of runtime in past decades, we must assume that some amount of major mechanical overhaul work would be prudent and required prior to making a decision to utilize this engine in the future. At the same time, for an engine of this size and vintage, the costs associated with replacing the radiator and silencer units along with upgrading controls and switchgear may be significant enough to remove it from further consideration. At 1100 kWe output, it just is not large enough to factor heavily into any serious plans for providing energy and/or capacity support for this utility. As a result, it is our determination that engine has also effectively reached the end of its useful service life at this facility.

Section 5

Smith Street Facility: Peaking Generator Units

Unit # 9: GM EMD Model 16-567-D4

S/N: 65-K1-1007

Date of Manufacture: 1965

Date of Installation: 1966

Facility Heat Rate: 11,030 Btu/kWh

Fuel: No. 2 Fuel Oil (Diesel)

Governor: Woodward LSG-10

Nameplate Electrical Output: 2000 kW

Generator Output Voltage: 4160V

Date of Last Operation: C/Y 2008

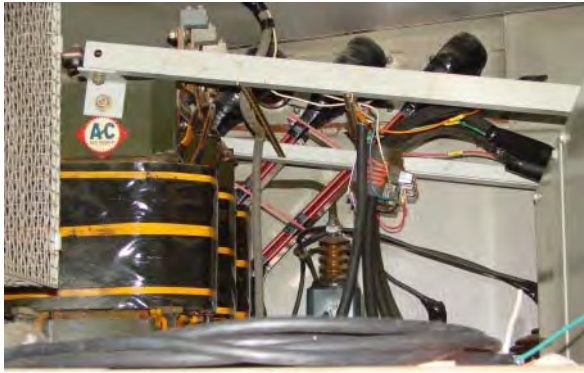


Description: Engine manufactured by the Electro-Motive Diesel division of GM. This unit is a 16 cylinder model with turbo, approx. 2800 Bhp at 720 RPM. UCNSB classifies this engine as a “peaking unit.” It is fully contained in a stand-alone enclosure which houses the engine-generator, a fan-cooled radiator unit, air intake, and a shrouded overhead exhaust silencer. This unit is capable of remote start. Three unsuccessful attempts results in a system control fault, disabling the remote start feature. UCNSB maintenance staff reports this engine had been rebuilt sometime in the 1980s and is currently in running condition today. Facility operating records indicate no runtime since calendar year 2008. Overall this engine appears sound with all components seemingly in place and functioning with the exception of the starting motor. The condition of the generator for this unit is reported to be good.

Discussion: Having been rebuilt within the past 25 years or so and under the presumption of minimal runtime during the past several years, there is no reason to conclude this engine is not in good, sound operating condition. That stated, we were made aware of the fact that there are at least two issues with this unit that prevent it from running if needed. First, the cooling fan sustained considerable damage during operation sometime in the recent past. As a result of some incident which is not fully understood, some of the fan blades were severely damaged during operation and remain so at the present time, (see photo). The damage has rendered this unit inoperable until and unless the fan is replaced.



Also during our visit, we have learned that a main dry-type transformer for the electrical switchgear servicing the entire group of three EMDs has failed. (Unit is shown in adjacent photo.) As a result, no power can be delivered from this EMD unit or any of the other two engines even if they could be operated. So though the engine would be capable of starting and running otherwise, the problems associated with these two components have effectively taken this engine out of service for the foreseeable future. UCNSB staff has given no indication as to when or more



importantly if either of these two problems will be corrected.

Though everything indicates the exhaust silencer on this unit is in good working condition, to continue to operate this unit under the new RICE regulations, it would require replacement with a new combination catalyst-silencer unit. The existing silencer is contained within the enclosure and essentially protected from the weather. It will not be possible to fit a replacement combination unit within the same confines. A replacement unit would need to be mounted on top of the enclosure and braced to withstand wind loads. Obviously, the appearance would not be as clean as what currently exists, but it would yield satisfactory results.

The following represents a probable cost estimate for the required repairs and/or replacement of major equipment items necessary to return this engine to a condition where it would be expected to provide consistent, reliable service on an as-needed basis:

a. Replacement transformer:	\$5,000
b. Upgraded engine controls:	\$160,000
c. Upgraded electrical switchgear & relays:	\$180,000
d. Replacement cooling fan & starting motor:	\$10,000
e. Replacement exhaust silencer with catalyst to comply with RICE NESHAP, installation, and testing:	\$95,000
f. CPMS monitoring equipment:	\$5,000
g. Engineering:	\$60,000
h. Other miscellaneous:	<u>\$40,000</u>
Total:	\$555,000

Remarks: Given the age of this unit along with the condition of the other equipment located at this facility, the decision not to repair this engine is completely understandable. This capital may be better invested in newer, more efficient engines that can offer reliable service for many years to come. With the added expense associated with complying with the new RICE NESHAP regulations, it would seem that the overall costs for repairs and upgrades for this unit are prohibitive. As a result, it is our determination that engine has also effectively reached the end of its useful service life at this facility.

Unit # 10: GM EMD Model 16-567-D4

S/N: 65-K1-1026

Date of Manufacture: 1965

Date of Installation: 1966

Facility Heat Rate: 11,030 Btu/kWh

Fuel: No. 2 Fuel Oil (Diesel)

Governor: Woodward LSG-10

Nameplate Electrical Output: 2000 kWe

Generator Output Voltage: 4160V

Date of Last Operation: Prior to C/Y 2006



Description: Engine manufactured by the Electro-Motive Diesel division of GM. This unit is a 16 cylinder model with turbo, approximately 2800 Bhp at 720 RPM. UCNSB classifies this engine as a “peaking unit.” It is fully contained in a stand-alone enclosure which houses the engine-generator, a fan-cooled radiator unit, air intake, and a shrouded overhead exhaust silencer. This unit is capable of remote start. Three unsuccessful attempts result in a system control fault, disabling the remote start feature. Apparently, some time ago, this engine seized during a startup sequence. UCNSB main-



tenance staff began to disassemble the engine to determine the problem and presumably to make the needed repairs. During our visit, we found the valve covers off of one side of the engine, heads removed from the other, a main pump drive detached (see photo), and the shrouding removed from the exhaust manifold. For reasons not entirely understood, work on this unit was suspended and has not resumed. Facility operating records indicate no runtime for at least the previous five years. The condition of the generator for this unit is reported to be good.

Discussion: Though this engine could probably be made to operate again, it is doubtful it ever will. To repair and rebuild an engine of this size is an enormous effort, requiring considerable more resources and manpower than is currently available at UCNSB. In addition, it also seems that the enclosure on this unit may be allowing rainwater to leak down on the exhaust silencer, the exhaust manifold and eventually onto the engine itself, (see adjacent photo). Not that this concern is an overwhelming one, but it may have created some other problems with this unit that are not yet realized.



As was the case for Engine #9, the exhaust silencer would need to be replaced with a combination catalyst-silencer unit to meet the new RICE regulations. This presents some retrofit problems given the manner in which the existing silencer is shaped and fitted into the enclosure. Again, this is not an insurmountable issue, but one to keep in mind in this situation. As presented in the discussion section for Engine #9, there is also the issue with the transformer associated with the switchgear that prevents operation of any of the three EMD units.

Remarks: We estimate the overall cost to repair this unit and return it to an operable condition would likely exceed \$1M inclusive of the costs associated with bringing this unit into EPA compliance and new engine controls. It seems overwhelmingly evident that this would not be money well spent, so effectively, this unit has already reached the end of its useful service life here at this facility.

Unit # 11: GM EMD Model 16-567-D4

S/N: 65-K1-1058

Date of Manufacture: 1965

Date of Installation: 1966

Facility Heat Rate: 11,030 Btu/kWh

Fuel: No. 2 Fuel Oil (Diesel)

Governor: Woodward LSG-10

Nameplate Electrical Output: 2000 kWe

Generator Output Voltage: 4160V

Date of Last Operation: C/Y 2006



Description: Engine manufactured by the Electro-Motive Diesel division of GM. This unit is a 16 cylinder model with turbo, approx. 2800 Bhp at 720 RPM. UCNSB classifies this engine as a

“peaking unit.” It is fully contained in a stand-alone enclosure which houses the engine-generator, a fan-cooled radiator unit, air intake, and a shrouded overhead exhaust silencer. This unit is capable of remote start. Three unsuccessful attempts results in a system control fault, disabling the remote start feature. UCNSB maintenance staff reports this engine is also seized. To date, no resources have been expended in an attempt to determine the location and extent of the problem. Facility records indicate no runtime for this unit since calendar year 2006. It is believed the engine seized shortly after the last significant run sometime during 2006. The condition of the generator for this unit is reported to be good.

Discussion: As has been previously stated, to repair and rebuild an engine of this size is an enormous effort, requiring considerable expense and resources. In addition and as was the case for Engines #9 and #10, the exhaust silencer would need to be replaced with a combination catalyst-silencer unit to meet the new RICE regulations. This presents some retrofit problems given the manner in which the existing silencer is shaped and fitted into the enclosure. Again, this is not an insurmountable issue, but does bear some consideration. Also, as presented in the discussion section for Engine #9, there is the issue with the transformer associated with the switchgear that prevents operation of any of the three EMD units.

Remarks: Without knowing any details as to the internal condition of this engine, it seems that a major overhaul is necessary in addition to other repairs and upgrades. We would estimate an overall cost in excess of \$1M to complete this work. As a result, in all likelihood, this unit has essentially reached the end of its useful service life here at this facility.

Section 6

Swoope Facility: Engine-Generator Units & Ancillary Equipment

Unit # 2: Fairbanks-Morse Model 38DD8-1/8

S/N: 970926

Date of Manufacture: 1966

Date of Installation: 1981

Approximate Heat Rate: 11,867 Btu/kWh

Fuel: Diesel (Dual-Fuel Capable)

Governor: Woodward UG-8

Nameplate Electrical Output: 910 kW

Generator Output Voltage: 4160V

Date of Last Operation: Prior to C/Y 2006



Description: Older model Fairbanks-Morse opposed-piston, 8 cylinder engine with blower, 1260 Bhp rating at 720 RPM. UCNSB maintenance staff reports this engine has not been started at all within the past three years. Facility operating records indicate no significant runtime in the previous five years. Though this engine may have had an original output rating of 910 kWe, UCNSB maintenance staff indicates they only operate it at about 600 kWe, approximately 65% output. We found the engine to be intact with all components seemingly in place and functioning. The condition of the generator for this unit is reported to be good, but it should be cleaned and tested prior to any extensive runtime.

Discussion: Despite the fact that this engine seems to be in good condition externally, perhaps the best indication we have of its actual condition is based on the reduced output from sustained operations several years ago. Though the engine may be capable of more than 65% output, we suspect the operating staff at this facility had good reasons for not pushing this engine for more. That coupled with the overall age of the engine and the fact that it has probably not been turned-over in at least three years are strong indications that some mechanical work is necessary to return this unit to its fully reliable operating condition.

We know from experience that the O-P engines are very well supported by the Fairbanks-Morse company. In fact, the O-P engines may still have the best support of any of the older engines produced. If a specific need for replacement parts was identified, or a decision was made to perform a major mechanical overhaul of this engine, we believe the necessary parts could be sourced from the OEM.

Though the engine itself may not be 100%, it seems the main reason for not running this engine anytime within the past few years was actually based on the condition of the radiator cooling unit. We were informed by UCNSB maintenance staff that there are at least two areas of major leaks within the radiator itself. A visual inspection of the unit shows a significant amount of corrosion throughout the unit not unlike that which we observed on the units located at the Smith Street facility. Below are photos of this particular radiator cooling unit. Though the age of this cooling unit is likely

less than those at the Smith Street facility, the environment at Swoope is probably more severe due to the closer proximity to the ocean. Obviously, the condition of this cooling unit has effectively rendered this engine inoperable.



The exhaust silencer attached to this engine appears to be in fair condition. It bears the outward coating of rust typical of a used silencer, but no perforations were evident. The inlet and outlet pipes seemed to be sound and securely in place. Certainly, one would expect to find some amount of internal corrosion due to the collection of rainwater, but it does not seem to have reached to point whereby this component requires replacement prior to starting and running this engine again. However, RICE NESHAP would mandate replacement prior to placing this engine back into service.



The following represents a probable cost estimate for the required repairs and/or replacement of major equipment items necessary to return this engine to a condition where it would be expected to provide consistent, reliable service on an as-needed basis:

a. Engine overhaul:	\$380,000
b. Updated engine controls:	\$160,000
c. Updated electrical switchgear & relays:	\$180,000
d. Replacement radiator cooling unit:	\$10,000
e. Replacement exhaust silencer with catalyst to comply with RICE NESHAP , installation, and testing:	\$70,000
f. CPMS monitoring equipment:	\$5,000
g. Engineering:	\$55,000
h. Other miscellaneous:	<u>\$40,000</u>
Total:	\$900,000

Remarks: Replacement parts and technical support are available to support an extensive overhaul of this engine. The fuel efficiency of this engine is not good, though some minor improvement may be expected with an upgrade to the engine controls. The output from this unit even after a major rebuild is too small to factor into any serious plans for providing energy and/or capacity for this utility. As a result, it is our determination that the costs to address the deficiencies in this engine and associated components are prohibitive, and this engine has effectively reached the end of its useful service life at this facility.

Unit # 3: F-M Model 38TDD8-1/8

S/N: 38D970348TDFS12

Date of Manufacture: 1982

Date of Installation: 1982

Approximate Heat Rate: 11,183 Btu/kWh

Fuel: Diesel (Dual-Fuel Capable)

Governor: Woodward Type PG-PH

Nameplate Electrical Output: 2412 kW

Generator Output Voltage: 4160V

Date of Last Operation: C/Y 2010



Description: Fairbanks-Morse opposed-piston, 12 cylinder engine with turbo-blower, 3360 Bhp rating at 720 RPM, and is equipped with a charge air cooler. Facility operating records indicate this ran most recently in calendar year 2010 for a total of two hours. The greatest amount of runtime within the past five years occurred in 2007. During that year, this unit was operated for a total of eleven hours. UCNSB maintenance staff indicates they operate engine at 2050 kW output, approximately 85% of nameplate rating. We found this engine to be intact with all components seemingly in place and functioning with good outward appearance. The condition of the generator for this unit is reported to be good.

Discussion: Overall this engine appears to be in good condition. But without the benefit of any diagnostic tests, we can only speculate as to its internal condition and that of its main components. For an engine of this vintage, an 85% output for its most recent sustained still seems strong, thus it remains potentially viable for future service in this power plant. The engine's perceived condition along with the availability of replacement parts and good technical support from the OEM further supports this.

That stated, this engine system is only marginally functional due to the condition of the cooling units necessary for proper operation. Because of the charge air cooling system, there are two cooling units associated with this engine, a radiator and a separate cooling tower. Neither unit seems to be in good condition (see photos below). The housing and frame of the radiator unit are severely rusted. The exterior of the cooling tower is badly weathered and has a few large openings in the side panels. The

current condition of this equipment is clearly not conducive to allow extended runs of this engine and both will require replacement in order to allow this unit to run reliably in the future.



The exhaust silencer for Engine #3 seems to be in reasonably good condition. It is a large, ground-



mounted unit with a complete platform and ladder assembly in place for conducting stack tests (shown in photo). The outer bands at one time served as mounting for a heat shield. Apparently part of this shield was removed to make some repairs to the outer shell of the silencer for Engine #4. This work was performed at the time of the last stack test some five years earlier. More of the shielding was blown off during a storm or perhaps a recent hurricane.

Though the outer shell of this silencer unit is rust-covered, no perforations or weakened areas were immediately evident. There is a considerable amount of rust debris at the base of this unit, so the likelihood of a buildup of rust internally is also high. But since this engine ran as recently as 2010 and each year prior, the quantity of rust debris in this silencer may not as significant as in other units. Regardless, because of the RICE NESHAP regulations, a combination catalyst-silencer unit would be a suitable and recommended replacement.

The following represents a probable cost estimate for the required repairs and/or replacement of major equipment items necessary to return this engine to a condition where it would be expected to provide consistent, reliable service on an as-needed basis:

a. Updated engine controls:	\$160,000
b. Updated electrical switchgear & relays:	\$180,000
c. Replacement radiator cooling unit:	\$10,000
d. Replacement cooling tower:	\$65,000
e. Replacement exhaust silencer with catalyst to comply with RICE NESHAP , installation, and testing:	\$90,000
f. CPMS monitoring equipment:	\$5,000
g. Engineering:	\$50,000
h. Other miscellaneous:	<u>\$40,000</u>
Total:	\$600,000

Remarks: Though this particular engine seems to be in good condition and apparently still runs well, the investment is high to replace the cooling units, exhaust silencer, and update the engine controls for an engine of this vintage. Also, because of the rather poor fuel efficiency for this engine, operating costs would remain high. However, it is among the newest of the engines at any of the UCNSB power plants, and certainly maintains some level of viability for future use.

Unit # 4: F-M Model 38TDD8-1/8

S/N: 38D873068TDFS12

Date of Manufacture: 1982

Date of Installation: 1982

Approximate Heat Rate: 11,183 Btu/kWh

Fuel: Diesel (Dual-Fuel Capable)

Governor: Woodward Type UG-8

Nameplate Electrical Output: 2412 kWe

Generator Output Voltage: 4160V

Date of Last Operation: C/Y 2009



Description: Fairbanks-Morse opposed-piston, 12 cylinder engine with turbo-blower, 3360 Bhp rating at 720 RPM, and is equipped with a charge air cooler. Facility operating records indicate only very few runtime hours within the previous five years. UCNSB maintenance staff indicates they operate engine at 2275 kWe output, approximately 95% of nameplate rating. We found this engine to be intact with all components seemingly in place and functioning with very good outward appearance. The condition of the generator for this unit is reported to be good.

Discussion: A 95% output for a sustained run for an engine of this vintage seems to be a good indication of the overall condition of the engine itself. Though this engine perhaps never figures to be a major part of the overall energy or capacity needs for this utility, it seems that it still has potential for additional service here. Clearly, it should be ‘exercised’ more often than has been the case recently to remain a viable unit for power generation. Again, we would claim that support for this engine from the OEM would be more than satisfactory.

But similar to other units at this facility and at Smith Street, the condition of the ancillary equipment does not allow this engine to be operated as often or as reliably as may be desired or required. As with Engine #3, there are two cooling units tied to this engine, a radiator and a separate cooling tower. Unfortunately, neither of these units is in particularly good condition. The radiator panels are severely rusted with some noticeable perforations. The cooling tower may be in a little better condition, but it too is questionable (see photos on following page). Clearly this environment so close to the ocean has resulted in the deterioration of this equipment. It seems evident that both of these units should be replaced soon if this engine-generator is needed in the future for reliable service.



The exhaust silencer for this engine is a large, ground-mounted unit with a complete testing platform installed (see photo). The outer bands at one time served as mounting for a heat shield. Apparently part of this shield was removed to make some repairs to the outer shell of the silencer as evidenced by the patches. This work was performed at the time of the last stack test some five years earlier. More of the shielding was blown off during a storm or perhaps a recent hurricane.



Other than the patches, at first glance this unit appeared to be in fairly good condition. However, this is apparently not the case. According to UCNSB maintenance staff, there is a considerable amount of rust buildup inside the unit. The concrete pad on which the unit rests was thoroughly coated with significant amount of rust debris.

So even though this engine is presently listed as being in an operable condition, that status is suspect due to the condition of the cooling units and exhaust silencer. The silencer may be marginally functional, but the efficiency and effectiveness of the cooling units may not allow a sustained run of this engine at this time. Certainly, it does not make for a very reliable operation.

The following represents a probable cost estimate for the required repairs and/or replacement of major equipment items necessary to return this engine to a condition where it would be expected to provide consistent, reliable service on an as-needed basis:

a. Updated engine controls:	\$160,000
b. Update electrical switchgear & relays:	\$180,000
c. Replacement radiator cooling unit:	\$10,000
d. Replacement cooling tower:	\$65,000
e. Replacement exhaust silencer with catalyst to comply with RICE NESHAP installation, and testing:	\$90,000
f. CPMS monitoring equipment:	\$5,000
g. Engineering:	\$50,000
h. Other miscellaneous:	\$40,000
Total:	\$600,000

Remarks: As was the case for Unit #3, this engine also seems to be in good condition and apparently still runs well. But likewise, a considerable investment would be necessary to replace the cooling units, exhaust silencer, and update the engine controls. But as it too is among the newest of the engines owned by UCNSB, it may be worthy of that amount of capital investment should there be an interest on the part of UCNSB for doing so.

Section 7

Summary and Concluding Remarks

In conducting our assessment of the generation equipment located at UCNSB's Smith Street and Swoope power plants, we have attempted to be as thorough as time and resources would permit. Each unit, regardless of its condition or operating status was given an unbiased assessment. As we considered these assessments, it was important to look at each unit in terms of capital investment required to update and return each to a state of readiness and reliable operation.

With few exceptions, we found significant deficiencies in one or more pieces of equipment associated with each of the generating units. In many cases, the engines themselves may have been functional, but the condition of a corresponding cooling unit or exhaust stack was so poor that they could not have run. In other instances the engine itself was inoperable. None of these situations is without remedy. Where necessary, the engines can be overhauled as replacement parts seem to be available. Cooling units can be replaced. If the engines are to function as anything other than emergency backup units, the exhaust silencer units would require replacement with combination catalyst-silencer units to meet RICE NESHAP requirements. There are qualified vendors capable of supplying new engine control panels and electrical gear. Any of the known and identified problems with each unit can be corrected, but it will be costly to do so. The estimated costs to make these changes and update averages approximately \$800,000 per unit. That is a considerable amount of capital to invest in engines that are 50 to 60+ years old.

Essentially, two points became very clear during this assessment study. First, the state of this equipment as it currently exists is not adequate to provide for capacity or energy should a real need occur. Some engines could be made to run on a very limited basis if needed. The associated equipment necessary to run each engine is questionable at best with much of it being completely inoperable. Even if the mechanical equipment was functional, we have genuine doubts and concerns as to the reliability and more importantly the safety of the electrical panels and switchgear. The condition of the electrical equipment alone is enough to render this equipment inoperable until repaired or replaced.

The second point and the one that begins to tie all of this together is the impression that UCNSB wants internal generation and is ready to move on from these power plants. Obviously, the UCNSB staff and personnel have a realistic view of the condition of their equipment and facilities, and our report confirms this without stating anything not already known or suspected. Equipment and buildings have a certain useful service life and these resources have met and probably exceeded any realistic expectations expressed at the time of installation. It seems that time has come to look at other options and to plan for system and load growth.

As indicated, the engine-generator units can be returned to a state of operation and readiness with the expenditure of significant capital. We are certain that the replacement and/or overhaul of the equipment along with the installation of new engine controls and electrical gear would result in operable units. However, the units are still very inefficient and would be of little value for energy, providing only capacity and reliability functions. Also, as had been previously indicated, significant additional costs would be required for building renovations. Probable costs for a new power plant building could easily add another \$2M to \$4M to this project. Costs to move each engine from its present location and re-install at another site could top \$50k to \$60k per unit. Again, any of this work is possible, but to repair,

update, and possibly relocate the existing engine-generator units is a backward-looking approach. UCNSB seems ready for new larger and more efficient generation to replace the old outdated equipment.

During our discussions, we have learned that both the Smith Street and Swoope properties have commercial appeal. The Smith Street property is desirable based on its proximity to the hospital, and apparently the Swoope property has potential use as a marina or something similar. As a result, it seems both properties could be put to other uses at a potential capital gain for the City of New Smyrna Beach.

To accommodate this, the engine-generator units would need to be relocated or otherwise removed from the existing sites. Though we do not have any particular details at this time, it seems that some engines may hold a certain resale value. In particular, the newer Fairbanks-Morse OP engines and the two Enterprise units may hold the most value. At a minimum, we would expect to find firms willing to move most or perhaps all of the engine-generator units for transfer of ownership at relatively little or no cost to the utility. That may be the most reasonable expectation for UCNSB.

With the ownership and availability of the property west of Interstate 95, there are a number of possibilities open to UCNSB to re-power and own a facility that not only provides for a portion of its capacity requirements, but could also possibly generate savings from the energy produced. In stark contrast to the power plant facilities in place here today, a new power plant at the UC West property could become a source of community pride and accomplishment in addition to providing dependable and reliable electric power to the electric customers during an emergency or other type of outage. We believe that would come as a welcome relief to those in this utility most closely involved with the existing power plants.