



## Project Summary

# Report on the Usefulness of AVHRR and CZCS Sensors for Delineating Potential Disposal Operations at the 106-Mile Site

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Data from the AVHRR sensor for 18 TIROS-N series satellite passes were examined for signs of ocean disposal at 106-Mile Disposal Site off the Northeast Coast of the United States. The passes selected occurred within five days following the actual disposal. All spectral channels were analyzed. In addition, the difference and the ratio of channels 1 and 2 were used.

No dumping is evident in any of the images. If dumping is actually visible, the signal must be very weak at the 1 km resolution of the AVHRR sensor. Because of this, the images would have to be absolutely clear. Small scattered clouds or thick haze add too much variability to permit detection of a weak signal which renders AVHRR data of marginal value for such work.

Because the exact location of the dumps was not known, it is possible that the signal is detectable. For this to be true, the dumps would have had to occur quite far from the location provided in the Coast Guard records. These records give only the site (e.g., dumpsite 106), not actual coordinates.

*This Project Summary was developed by EPA's Environmental Research Laboratory, Narragansett, RI, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).*

### Introduction

As part of its ongoing monitoring activities for the 106-Mile Ocean Disposal

Site, the Environmental Protection Agency (EPA) contracted to the University of Rhode Island (URI) to investigate the possibility of detecting dumped waste in AVHRR satellite data. The primary focus was to be on the use of the visible channels (Channel 1: 0.55 - 0.9 $\mu$ m, Channel 2: 0.725 - 1.1 $\mu$ m for TIROS-N; Channel 1: 0.58 - 0.6 $\mu$ m, Channel 2: 0.725 - 1.1 $\mu$ m for NOAA-6 to NOAA-9) although consideration was also to be given to the IR channels (Channel 4: 10.5 - 11.5 $\mu$ m for TIROS-N, NOAA-6 and NOAA-8; and Channel 4: 10.3 - 11.3 $\mu$ m, Channel 5: 11.5 - 12.5 $\mu$ m for NOAA-7 and NOAA-9). Because the signal from the dumped material is thought to be very weak, and because of the substantial noise in Channel 3, that channel was not considered.

The reason that the EPA wished to consider AVHRR data for their monitoring program is the frequent coverage of the 106-Mile Site area by satellites carrying this sensor. In general, each satellite passes the area twice a day and there are generally two satellites collecting data; i.e., the dumpsite is covered between two and four times a day. NOAA-6 and NOAA-8 are in dawn-dusk orbits. Such orbits overfly any point at about 7:00 a.m. and 7:00 p.m., local sun time. TIROS-N, NOAA-7 and NOAA-9 are in orbits which overfly any point on the globe at 2:00 a.m. and 2:00 p.m., local sun time. This means that only one of the NOAA-7 and one of the NOAA-9 orbits overfly the dumpsite in daylight hours. NOAA-6 and NOAA-8 generally have both passes during daylight but at times corresponding to very low sun angles. This means that

very little sunlight penetrates the water column. Therefore, unless the dumped material is near the surface (top few centimeters) there will be little sunlight reflected from it; at best, it will be difficult to detect.

### Discussion

No disposal plumes were observed in any of the images analyzed. Many of the images which appeared to be clear when the data were initially scanned, often had light scattered clouds in them when processed at full resolution. Such clouds make it difficult to impossible to detect a weak signal in the visible channels. It is clear from this work that the disposal plumes, if apparent in the AVHRR visible data, will be very weak. This means that to observe these dumps the area will have to be absolutely clear. Furthermore, there will have to be significant solar penetration in the water column. The very clear dawn-dusk images showed nothing.

The question arises why disposal plumes are detectable in LANDSAT data and not in AVHRR data. The primary reason relates to the spatial resolution. LANDSAT MSS data has a resolution of 80 m compared to the 1.1 km resolution of the AVHRR. In the LANDSAT data, plumes at the 12-Mile Site in New York Bight although 10's of kilometers long, are generally less than 1km wide. To see such a plume in AVHRR data would require a substantial difference in reflectance with that of the surrounding waters.

To detect ocean disposal plumes from AVHRR data one would have to know exactly where to look. In this study, only

the date of the dump and the dumpsite were provided, not the precise location of the dump. Unless the dumps actually occurred far from the 106-Mile Site location used in this analysis, the signal even if detectable, is far too weak to be of value in a monitoring program.

The LANDSAT Thematic Mapper data should be analyzed to determine the size and spectral signature of the disposal plumes. With such data, to determine whether or not AVHRR visible data has any promise at all would be fairly straightforward.

The assumption is that CZCS data would provide a slightly better chance of discriminating disposal plumes because NIMBUS-7 passes overhead at approximately local noon when the penetration of solar radiation into the water column is at maximum, and because more spectral channels are available in the visible. Also, these channels have higher radiometric resolution than the AVHRR channels. However, because it was of very low quality due to degradation of the sensors, CZCS data were not considered.

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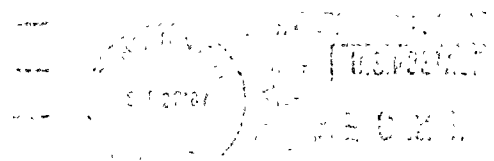
*The complete report, entitled "Report on the Usefulness of AVHRR and CZCS Sensors for Delineating Potential Disposal Operations at the 106-Mile Site," (Order No. PB 87-168 829/AS; Cost: \$9.95, subject to change) will be available only from:*

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